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UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 2 No. 9
MAY 15, 1949

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Technical Information Branch, Oak Ridge, Tennessee
AEC, Oak Ridge, Tenn., 5-15-49--1800-A6817

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NUCLEAR SCIENCE ABSTRACTS

Vol. 2 No. 9

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ABSORPTION AND SCATTERING OF RADIATION

1750 The Scattering of Fast Positrons and Electrons in Gold (For the Range 0.39-1.1 Mev.) by W B Lasich Australian J Sci Research 1 A 249-260 (1948) Sept

The Wilson cloud chamber has been employed with the method of projected angles [O'Ceallaigh and MacCarthaigh, Proc Royal Irish Acad 50 A 13 (1944)] in a study of the scattering of positrons and electrons in thin gold foil, for the energy range 0.39-1.1 Mev. The small angle scattering was found to be in reasonable agreement with current multiple scattering theory. Further, the results obtained in the investigation of the large angle scattering favor a spin orbital interaction, and the absolute intensity of the scattering for positrons and electrons under these conditions is believed to be approximately correct. 6 figures; 11 references.

ASTROPHYSICS

1751 A Search for Isotopes of Titanium in Late-Type Stars by George H Herbig Pubs Astron Soc Pacific 60 378-380 (1948)

The intensities of the bandheads of $Ti^{46}O$, $Ti^{47}O$, $Ti^{49}O$, and $Ti^{50}O$ relative to $Ti^{48}O$ in the spectra of some giant and supergiant stars of classes M1 to M4 indicate abundances of these isotopes comparable with their terrestrial abundances.

ATOMIC BOMBS AND WARFARE

1752 Atomic Bomb—The X-Factor of Military Policy by H B Seim U S Naval Institute Proc 75 387-393 (1949) Apr

The possibilities and limitations of the atomic bomb as a military weapon are reviewed briefly. Some of the psychological, physical, military, economic, and political effects which can result from the use of atomic bombs in warfare are discussed. It is concluded that it would be unwise to rely solely on the atom bomb as our military source of national security.

BIOLOGICAL EFFECTS OF RADIATION

1753 Effects of Ionizing Radiations on Enzyme Activities of Yeast Cells I. Relation between Anaerobic CO_2 Production and Colony Production at Intervals after X-Radiation by Frederick G Sherman and Herman B Chase J Cellular and Comp Physiol 33 17-25 (1949) Feb

The effect of X-radiation on enzyme systems in vivo was tested by irradiating yeast which had been grown on a supplemented Reader's medium. The anaerobic CO_2 production of S. cerevisiae is inhibited approximately 30% by irradiation with X-rays (90,000 r at 3,000 r per min.). At the same time approximately 85% of the irradiated cells are unable to form visible colonies on solid medium. Between 12 and 24 hours after irradiation the anaerobic CO_2 production of the irradiated cell suspensions on a per cell basis shows a progressive decline which may suggest that some "injured" cells have had a further reduction in ability to ferment glucose or have lost it entirely. Yeast cells irradiated with X-rays apparently release "proliferation-promoting" substances and compounds which serve as nitrogen sources.

1754 Influence of Temperature on the Response of Frogs to X Irradiation by Harvey M Patt and Marguerite N Swift Amer J Physiol 155 388-393 (1948) Dec

Toxicity is not influenced by altering the body temperature of frogs during and/or for the first 24 hours after total-body X-irradiation with 1000 r and 3000 r. Survival is greatly enhanced, however, as long as the animals are kept in the cold (5°-6°C) continuously after the exposure. This altered sensitivity is due apparently to a decrease in the rate of development of radiation damage (prolongation of the latent period) rather than to any appreciable recovery. When the animals are removed from the cold after periods of 60 to 130 days, there is no change in absolute survival nor any clear difference in the time course of deaths from that observed in irradiated animals maintained at 23°C. These findings indicate that the metabolic level during exposure does not influence the overall radiation reaction in frogs and that the primary process of radiation damage is not repaired in the metabolically depressed animal.

BIOLOGICAL EFFECTS OF RADIATION (continued)

1755 Proceedings of the American Physiological Society Amer J Physiol 155 425-481 (1948) Dec 1

The following papers were among those presented at the First Fall Meeting of the American Physiological Society, held at the University of Minnesota, Minneapolis, and at the Mayo Foundation and Mayo Clinic, Rochester, Sept. 16-18, 1948: Influence of Estrogens on X-Ray Toxicity by R L Straube, H M Patt and M N Swift; X-Irradiation of the Hypophysectomized Rat by E B Tyree, M N Swift and H M Patt; Redistribution of Electrolytes (K^{42}, NA^{24}, P^{32}) Following Electroshock Convulsions in Rats by Dixon M Woodbury.

1756 Quantitative Inferences Concerning the Genetic Effects of Radiation on Human Beings by Robley D Evans Science 109 299-304 (1949) Mar 25

Genetic concepts and experiments pertinent to the question of mutations induced by irradiation are reviewed and calculations are made. It is noted that the induced mutations, which are similar in type to those appearing spontaneously in nature, have an average probability of about 3×10^{-8} per gene per roentgen for an irradiation of 0.6 roentgens per hour, or higher. Experimental results suggest that the effective average radiation sensitivity of immature sperm and eggs may be less than the sensitivity of mature sperm and eggs. Dominant mutations may become visible in the first generation offspring. Recessive mutations may appear only in homozygous individuals of a later generation, and therefore recessive mutations accumulate in the population as a result of both spontaneous and induced mutations. From the appropriate mathematical theory, and the experimental data now available, it seems safe enough to conclude that no detectable increase in hereditary abnormalities is likely to result, even after many generations, if a small fraction of the population receives daily radiation doses up to 0.1 roentgen per day. It is also noted that it is only rarely that any individual receives the maximum permited dose of 0.1 r per day and that the average daily dose at installations like the Hanford Engineer Works and the Oak Ridge National Laboratory is about 0.005 r per day. 29 references

BIOLOGY, GENERAL

1757 An Experimental Study of the Effect of Zirconium and Sodium Citrate Treatment on the Metabolism of Plutonium and Radioyttrium by Jack Schubert J Lab and Clin Med 34 313-325 (1949) Mar

This article is based on AECU-38 (ANL-4206). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-407.

CERAMICS AND REFRACTORIES

1758 Fundamental Study, and Equipment for Sintering and Testing of Cermet Bodies, I-III by A R Blackburn, T S Shevlin and H R Lowers J Amer Ceramic Soc 32 81-98 (1949) Mar 1

Cermet bodies, composed of metals and oxides, are being developed for high-temperature service. Part I covers the theoretical aspects of experiments of a fundamental chemistry nature which accompanied the laboratory development of test specimens. Compacts of metal powders (Ni, Fe, Co, Cr, and Cr-B) were fired at 2880° to 3500°F. on pure Al_2O_3 tile in various controlled atmospheres. The results indicate that a controlled layer of oxide on the surfaces of the metal-powder grains is essential for good bonding. Special furnaces, described in Part II, were necessary for the fundamental study and for sintering cermet specimens. Equipment for determining instantaneous modulus of rupture and tensile rupture, and long-time stress-rupture in bending at temperatures up to 2400°F., is described in Part III.

CHEMISTRY, ANALYTICAL

1759 **Techniques in the Use of C^{14}** by Robert Steele and Theodore Sfortunato. AECU-172 (BNL-T-6) Feb 25 1949 15p

This paper describes several devices and procedures which have been found useful in work with radioactive carbon in the laboratory. Included are: (1) a wet oxidation method for the determination of total carbon and of the specific activity of carbon in organic materials, (2) a method for collecting barium carbonate samples on sintered glass disks for counting, and (3) a lightweight transparent canopy which can be placed on a laboratory bench top to furnish additional hood space for work with radioactive carbon.

CHEMISTRY, GENERAL

1760 **Metal Carbonyls. Part II A Bibliography of Published Literature** by Fred E Croxton. AECU-171 (K-365 Part II) Mar 22 1949 149p

A collection of approximately 500 titles and abstracts on metal carbonyls of all kinds has been compiled. Subject and reference indexes are included.

1761 **Intermediates for the Preparation of Ring-Labeled Benzene** by Wesley E Shelberg and B M Tolbert. AECU-178 (UCRL-281) Feb 1 1949 20p

The preparation of radioactive acetylenedicarboxylic acid, for use in the preparation of benzoic acid labeled in the ring with C^{14}, by the carbonation of acetylene dimagnesium bromide solutions was examined under various conditions and found to be impractical. Calcium carbide does not yield calcium acetylenedicarboxylate by carbonation in the pressure and temperature ranges of 900-5675 psi and 22-335°C.

1762 **The Synthesis of dl-Tryptophan-β-C^{14}, Indole-3-Acetic Acid-α-C^{14} and dl-Tryptophan-3-C^{14}** by Charles Heidelberger. AECU-179 (UCRL-307) Mar 15 1949 8p

DL-tryptophane-β-C^{14} was synthesized by the condensation of gramine with ethylacetamidomalonate followed by hydrolysis. The overall yield was 19% based on CO_2. Indole-3-acetic acid-α-C^{14} was prepared by a method which involves the alkylation of KCN by gramine, followed by hydrolysis. dl-Tryptophane-3-C^{14} was prepared by converting carboxy labelled benzoic acid to indole-3-C^{14}. The indole-3-C^{14} was converted to gramine, and the dl-tryptophane-3-C^{14} was formed by the condensation of gramine with ethylamidomalonate followed by hydrolysis.

1763 **Pilot Plant Preparation of Diborane** by H W Carhart, R H Blizzard, J E Johnson, J A Krynitsky and S H Smith Jr. Naval Research Laboratory Report NRL-C-3405

A pilot plant comprising three independent production units was constructed for the preparation of diborane according to the following equation: $3\ LiBH_4 + BF_3 \cdot (C_2H_5)_2O \xrightarrow{\text{ether}} 2\ B_2H_6 + 3\ LiF + (C_2H_5)_2O$. A total of 4.2 Kg of diborane of about 95 per cent purity was prepared in forty-seven runs with an over-all yield of 90.9 per cent based on the lithium borohydride. A production unit was essentially all glass and consisted of a reactor connected to suitable cold traps for purification and transfer of the product. The reaction was carried out under an inert atmosphere and transfers to storage bombs were made at reduced pressure.

1764 **A Synthesis of Adenine. The Incorporation of Isotopes of Nitrogen and Carbon** by Liebe F Cavalieri, John F Tinker and Aron Bendich J Amer Chem Soc 71 533-536 (1949) Feb

Various syntheses of adenine have been investigated and a satisfactory procedure for the introduction of isotopes of nitrogen and carbon has been developed. The preparation from isotopic carbon of cyanoacetamide and malononitrile is described.

COSMIC RADIATION AND MESONS

1765 Cosmic Ray Measurements Made during the Cruise of H. M. A. S. Wyatt Earp 1947-48 by D E Caro, P G Law and H D Rathgeber Australian J Sci Research 1 A 261-274 (1948) Sept

This paper describes the cosmic ray equipment used and the results obtained on a ship between Melbourne, Australia, and the Antarctic Continent. Measurements of the total cosmic radiation over a narrow solid angle, the meson content over the same angle, and the total content over the full hemisphere were made. The difficulty of carrying out multiple correlations, when the independent variables are closely related, is discussed. The final correlation results show barometric coefficients of −0.144% per millibar (mb.) for the narrow angle total radiation, −0.114 for the meson content, and −0.192 for the total wide angle record. Long term temperature coefficients of −0.063% per degree C, −051% per degree C, and −0.012% per degree C, respectively, are obtained. The need to separate the daily and long-term temperature coefficients in regions where continental climates exist is shown. Daily temperature coefficients of 0.14% per degree C, 0.24% per degree C, and 0.16% per degree C are obtained. It is found that no measurable latitude effect remains after pressure and temperature corrections have been made. The ratios of the total to meson content and the narrow angle intensity to wide angle intensity are independent of latitude south of Melbourne. A possible effect due to a magnetic disturbance on February 15 is noted, but later more severe storms did not produce any noticeable result. The results obtained are compared with those of other workers. 7 figures 18 references

1766 A Cosmic-Ray Particle of Charge Two or Greater by R W Safford and A M Thorndike Phys Rev 75 903-904 (1949) Mar 1 (Letter to the editor)

A cloud-chamber photograph has been obtained at an altitude of 93,000 feet which shows a heavily ionized track penetrating a 1.25-cm lead plate. It is estimated that between the two plates the heavily ionizing tracks has a density of ionization between 10 x and 100 x minimum ionization. If the ionization is considered to be as high as 100 x minimum, then the particle must have $7 \leq Z \leq 10$, assuming that its mass is 2Z. Thus the estimate of ionization between 10 x and 100 x the minimum for a particle of unit charge implies a charge not less than two nor more than ten, with higher charged resulting from higher estimates of the ionization. In the absence of an accurate determination of the density of ionization of the track, it seems most probable that it was caused by an α-particle having an energy of the order of 400 Mev. The high energy and approximately vertical incidence make it probable that a primary particle is involved, similar to those found by Freier, Lofgren, Ney and Oppenheimer [Phys Rev 74 1818 (1948)].

1767 Cross-Section for Nuclear Disintegration Produced by Cosmic Rays by J B Harding Nature 163 440-441 (1949) Mar 19 (Letter to the editor)

In order to investigate the suggestion that the cross-section for star production is proportional to the geometrical cross-section of the nucleus [George, Nature 162 333 (1948)], "gelatin sandwich" plates were exposed for fifty days at an altitude of 3650 m. The ratio of the number of stars observed in the gelatin to those occuring in the emulsion has been determined as $5.8 \pm 0.7\%$. From theoretical calculations it is concluded that the ratio of the cross-sections for star production in light and heavy nuclei is greater than the ratio of their nuclear cross-sections. The gelatin stars observed are analyzed in some detail and a histogram of the range distribution of the complete heavily ionized tracks is given.

1768 Discussion on the Disintegration and Nuclear Absorption of Mesons Revs Modern Physics 21 31-36 (1949) Jan

In a discussion on the disintegration and nuclear absorption of mesons the following subjects were treated: "Introductory remarks" by B. Rossi; "Recent cloud-chamber experiments at Massachusetts Institute of Technology" by C. D. Anderson; "Cloud chamber measurements of the energy of decay electrons" by B. Rossi; "Remarks on μ-decay" by J. R. Oppenheimer; "Decay of mesons in aluminum" by G. E. Valley; "Capture and disintegration of sea-level mesons" by R D Sard.

COSMIC RADIATION AND MESONS (continued)

1769 Extensive and Penetrating Atmospheric Showers by R Maze, A Fréon, J Daudin and P Auger Revs Modern Physics 21 14-20 (1949) Jan

Data on the properties of the particles of extensive atmospheric showers have been obtained by means of absorption measurements conducted with counters and by making measurements of the shower-producing properties of particles having traversed variable thicknesses of lead. The following conclusions have been drawn from the data obtained: 1) There are two types of groupings of particles in the showers originating in the middle of the atmosphere. One is very local and the second is very extensive. These two groups of particles are independent and do not vary with altitude in the same way in the lower atmosphere. 2) Both groups of particles undergo an absorption of the same order of magnitude in lead but in the group of small extension the measurements are complicated by the intervention of secondary phenomena in the shield itself. The particles of the widely spread type (extensive showers) are absorbed to such an extent that their number declines by a factor of 10 for 10 cm of lead in the region between 5 cm and 12 cm of lead. This corresponds to a mass coefficient of absorption of about 40 g cm^{-2}. For larger thicknesses, the absorption coefficient decreases materially. The absorption coefficient in the region of from 15 cm to 20 cm of lead is certainly higher than 100 g cm^{-2}. 3) With this change in the absorption coefficient, a difference in the distribution of the particles is noticeable. The horizontal spread of the very penetrating fractions of extensive showers becomes much smaller than that of their highly absorbable parts. 4) The very penetrating parts of extensive showers (beyond 20 cm of lead) produce in the lead numerous secondary electrons. 5) In the study of coincidences between near counters, under thick lead shields (10 cm to 20 cm), a local phenomenon produced in the lead is substituted for the local atmospheric phenomenon, and it is uncertain whether it has the same cause. The absorption coefficient of this local secondary phenomenon is of the order of 100 to 200 g cm^{-2}, that is to say, of same order as the decrement of extensive showers in the atmosphere and also of local showers above 3000 m. 6) The absorption of extensive shower particles between 5 cm and 15 cm of lead does not correspond either to electrons or to mesons.

1770 Heavy Nuclear Splinters by P E Hodgson and D H Perkins Nature 163 439-440 (1949) Mar 19 (Letter to the editor)

Two stars were observed, in a total of 6000 obtained in "sandwich" emulsions at 3,500 m, in which highly charged nuclear splinters were ejected from strongly excited nuclei before equilibrium had been attained. A photomicrograph of the complete disintegration of a bromine nucleus, in which at least 18 particles are given off, is shown. A heavy fragment which has been identified as a particle of charge $11 \pm e$, having an energy estimated as 325 ± 50 Mev, is responsible for a 195 μ, heavy track which is shown, The excitation energy required to produce this star is estimated as 700 Mev and evidently the primary particle responsible for the disintegration has a charge less than 3. The authors note a recent publication of Bonetti and Dilworth (Bulletin de l'Université Libre de Bruxelles Note No. 7, January 1949) in which a similar track is described.

1771 High Energy Particles, Bursts, and Showers by J Clay Revs Modern Physics 21 94-100 (1949) Jan

A series of experiments was performed to obtain information on the nature of extensive cosmic ray showers and the relationship between such showers and bursts. Various types of coincidence-counter and ionization chamber data obtained are given in tabular and graph form. The energy of the primary shower-producing particles has been estimated as lying in the range $3 \times 10^{13} - 3 \times 10^{14}$ ev per m^2. From this the minimum energy of extensive showers having a frequency of 1 in 6000 hours is determined as about 10^{16} ev.

COSMIC RADIATION AND MESONS (continued)

1772 Influence on the Cosmic-Ray Spectrum of Five Heavenly Bodies by Evan O Kane, T J B Shanley and John A Wheeler Revs Modern Physics 21 51-71 (1949) Jan

The trapping of externally incident particles in the magnetic field of the sun through deflection by the magnetic field of the earth is here investigated quantitatively according to Alfvén's recent theory [Phys Rev 72 88 (1947)]. The consequent form of the cosmic-ray spectrum to be expected at the earth, on the hypothesis of a constant solar field and relatively small or zero magnetic moments for the other heavenly bodies which also intercept these trapped particles (i.e., Venus, Mars, and the moon) is considered. Tabulated data are given for the cut-off of the cosmic-ray spectrum by the sun's field which is expected on the basis of simple theory, overlooking contributions of particles trapped in the sun's field. Curves are also given for the absorption cross sections of the earth, sun, moon, Venus, and Mars as a function of the direction of arrival of cosmic-ray particles at the earth's orbit. A more detailed analysis, including a discussion of relevant parts of the Störmer-Lemaitre-Vallarta theory, is also included. 19 references 6 figures.

1773 Latitude Effect and Pressure-Level of Meson Formation by A Duperier Nature 163 369-370 (1949) Mar 5 (Letter to the editor)

Kupferberg [Phys Rev 73 804 (1948)] and Rathgeber [Nature 162 303 (1948)] have pointed out that the latitude effect of cosmic rays due to the geomagnetic field may be partially masked by the fact that the height of the pressure-level of meson formation increases toward the equator. The author further notes that a correction must be applied as a consequence of the increase of the temperature at the level of meson production with latitude. The intensity at sea level increases with increasing temperature or decreasing density at the rate of 0.11 per cent per °C, i.e., at the rate of about −0.22% for a change of air density at the region of production of about 1.0%. A curve of the temperature at the 100 mb level as a function of geographic latitude is shown which indicates that the intensity of the mesons should increase 4% from the equator to latitude 60°. In the event that the mesons are not formed at the same pressure-level in all latitudes, as has been assumed, but are formed at a pressure-level lower than 100 mb. near the equator, the atmospheric effects under consideration would result in a difference in sign between the two corrections. Thus, it is possible that the latitude effect as observed at sea-level is almost entirely due to the deflecting action of the geomagnetic field, owing to the accidental cancelling of the corrections due to the height and to the temperature of the production level. It will be possible to determine the magnetic latitude effect accurately when the variation of the height of the level of formation with latitude has been determined.

1774 The Mass of the Cosmic-Ray Mesotrons by Robert B Brode Phys Rev 75 904-905 (1949) Mar 1 (Letter to the editor)

Using a more accurate method of treating the data on mesotrons obtained by Fretter [Phys Rev 70 625 (1946)], the mesotron mass has been determined as 212 ± 5, as compared with the value of 202 ± 5 (in units of electron mass) obtained by Fretter. The error in the earlier value is the result of treating the data as a set of linear measurements.

1775 Neutron Production by Cosmic Rays at Sea Level by A R Tobey Phys Rev 75 894-895 (1949) Mar 1 (Letter to the editor)

The rates of production of neutrons in paraffin, lead, and aluminum by cosmic rays at sea level have been measured using a boron trifluoride cylindrical ionization chamber as a detector. The values obtained for paraffin, lead, and aluminum were 2.0×10^{-5}, 6.1×10^{-5}, and 2.3×10^{-5} neutron per sec per gm, respectively. Some of the corrections and details of the calculations are given; further details and additional measurements will be published in the future.

COSMIC RADIATION AND MESONS (continued)

1776 On the Mechanism of Sudden Increases of Cosmic Radiation Associated with Solar Flares by S E Forbush, P S Gill and M S Vallarta Revs Modern Physics 21 44-48 (1949) Jan

A preliminary theory to account for the sudden increases of cosmic radiation associated with the appearance of solar flares is presented. The data available on three flares and calculations based on these data are given below:

No.	1	2	3
Date	Feb. 28, 1942	Feb. 6, 1946	July 25, 1946
Magnetic Moment gauss-cm^3	7.8×10^{30}	3.5×10^{31}	3×10^{31}
Direction cosines:*			
α	0.01	0.11	−0.33
β	−0.90	0.97	0.90
γ	0.43	0.22	0.29
Spot diameter km	58000	52000	56000
Build-up time—days	≃6	≃6	≃6
Maximum field gauss	4800	3800	3800
Solar latitude—degrees	7N	27N	23N
Solar longitude—degrees	7E	13W	13E
Time hours GMT	12	16	17
Max. Energy Bev (of protons in field)	8.2	6.8	7.3
Energy Störmers (protons)	0.39	0.35	0.37
Minimum geomagnetic latitude	22	34	30

*Note: Z axis along negative permanent dipole, X axis in central meridian.

The fact that very few flares are accompanied by sudden increases of cosmic radiation seems to provide a sound argument for the existence of a permanent solar magnetic field. The role of the flare appears to be that of providing a supply of charged particles which are then accelerated by the variable field of the sunspots. It is noted that the mechanism responsible for changes in the intensity of cosmic radiation during magnetic storms is clearly different from that which is connected with sudden increases of intensity which follows the occurence of some solar flares.

A discussion by W. F. G. Swann, L. Davis, Jr., O. R. Wulf, S. E. Forbush and H. V. Neher is included. 10 figures.

1777 The Penetrating Particles in Cosmic-Ray Showers by G D Rochester Revs Modern Physics 21 20-26 (1949) Jan

A summary is given of the main results obtained using the Blackett electromagnet for the study of cosmic-ray showers, during the past 2 years. Two aspects of the showers are considered; firstly, the nature of the heavily-ionizing particles occurring in showers, and secondly, the nature of the lightly-ionizing particles in penetrating showers. The accuracy of the momentum determinations and the measurement of the curvature is discussed and several track photographs and data tables are given. The data taken lead the author to make the following conclusions: 1) Although many of the penetrating particles may be ordinary(μ) mesons, an appreciable fraction of the particles have properties different from μ-mesons. 2) The penetrating particles which interact with matter may be protons, π-mesons or heavier mesons. Identifiable slow protons are often present in the showers. 3) Some of the showers are very complex. There are complex showers which consist mainly of electrons and a few penetrating particles, and others which consist of large collimated groups of positively charged penetrating particles.

COSMIC RADIATION AND MESONS (continued)

1778 Photographic Evidence for the Existence of a Very Heavy Meson by Louis Leprince-Ringuet Revs Modern Physics 21 42-43 (1949) Jan

Previous evidence for the existence of a very heavy meson is summarized and some new evidence recently reported for the existence of a negative meson having a mass of at least 700 m_o [Compt Rend 226 1897 (1948)] is also discussed. The photograph, which recorded two stars linked together by the track of a σ-meson, is shown.

1779 The Present Status of the Evidence for the Atom-Annihilation Hypothesis by Robert A Millikan Revs Modern Physics 21 1-13 (1949) Jan

Evidence for the atom-annihilation hypothesis of the origin of cosmic rays in intergalactic space which has been obtained by the author in geomagnetic studies during the past 25 years is reviewed. Data are given for the cosmic ray intensity as a function of altitude for various localities having different geomagnetic latitudes. The evidence, in general, was found to favor the aforementioned theory.

1780 The Primary Soft Component of Cosmic Radiation by L Jánossy, Bruno Rossi and R I Hulsizer Nature 163 246-247 (1949) Feb 12 (2 letters to the editor)

Rossi's numerical interpretation [Revs Modern Physics 20 537 (1948)] of Hulsizers results [Hulsizer and Rossi, Phys Rev 73 1402 (1948)] on burst measurements which led to the conclusion that if a primary soft component exists at all, it constitutes not more than a few percent of the total primary intensity are discussed and concluded to be erroneous by Jánossy. Jánossy finds that a primary energy of 20,000 Mev, rather than the 4500 Mev assumed by Rossi, is required to give rise to a burst of eight particles in the burst chamber. This leads him to conclude that not more than 2% of the primary cosmic rays are electrons with energies in excess of 20,000 Mev. It is concluded that no significant upper limit for the strength of the primary component can be derived from Hulsizer's measurements and that although these measurements do not prove the existence of a soft component, there is no valid experimental evidence disproving the existence of a primary soft component.

Rossi and Hulsizer, in a second letter, comment upon Jánossy's letter. Although the former agree that a revision of Rossi's earlier calculations is in order, the values they obtained are considerably different and the experimental justification of the differences is presented. A primary energy of 10,000 Mev, rather than the 20,000 Mev suggested above, is the estimated value necessary to give rise to a burst of 80 particles in the burst chamber and the cut-off energy is hence placed at 4,000 Mev, rather than the 2,000 Mev value estimated by Jánossy. From this, an upper limit for the number of electrons in the primary radiation is estimated to be about 11%. However, this value is subject to qualification due to the uncertainty of the shower theory for the heavier elements. In conclusion, it is suggested that further experiments will be necessary to establish whether electrons exist in the primary cosmic radiation.

1781 Results and Problems Concerning the Extensive Air Showers by G Cocconi Revs Modern Physics 21 26-30 (1949) Jan

A description of the results which have been obtained and some of the problems yet to be solved in connection with the study of extensive cosmic-ray showers is given from the experimental point of view. The various components of extensive showers, i.e., soft, penetrating, and neutron, are discussed in turn.

1782 A Search for Electrons in the Primary Cosmic Radiation by Robert I Hulsizer. MIT Laboratory for Nuclear Science and Engineering Technical Report No. 20 (Office of Naval Research Contract) Jan 21 1949 85p (NP-705) (See also Nuclear Science Abstract I-78)

An experiment was sought which would measure directly the intensity of electrons at the top of the atmosphere. To set an upper limit on the intensity of electrons in the primary radiation, the rate of bursts in an unshielded ion chamber was subtracted from the rate of bursts under lead. There were 2111 pulses in 27.8 minutes at 27 gm cm^{-2} that were large enough to have been caused by the

COSMIC RADIATION AND MESONS (continued)

ionization from a shower initiated by a 4.5 Bev electron or photon. Of these, 320 would have occurred without the lead. Dividing this rate of bursts by the sensitive area and solid angle of the apparatus a rate of $0.0069 \pm .00018$ sec^{-1} cm^{-2} $sterad^{-1}$ is obtained as an upper limit on the intensity of electrons or photons at a depth of 27 gm cm^{-2}. The total intensity of the charged primary cosmic radiation has been found to be 0.07 sec^{-1} cm^{-2} $sterad^{-1}$. Therefore the electron or photon component of the radiation constitutes no more than 10 per cent of the total charged radiation. It is not necessary to postulate the existence of an electron component, however, for the production of electrons in nuclear interactions with the primary radiation has been established.

1783 Some Preliminary Cloud-Chamber Photographs of Artificial Mesons by Walter Hartsough, Evans Hayward and Wilson M Powell. Phys Rev 75 905-906 (1949) Mar 1 (Letter to the editor)

This article is based on AECU-152 (UCRL-271). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-1547.

1784 Theory of Meson Production by W Heitler Revs Modern Physics 21 113-121 (1949) Jan

After discussing some of the difficulties involved in developing a satisfactory theory of meson production the following are treated: 1) meson production by nucleon-nucleon collisions, 2) multiple production of mesons, and 3) production of mesons by photons.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1785 Determination of Absolute Intensities of X-Ray Reflexions from Relative Intensity Data by S H Yü Nature 163 375-376 (1949) Mar 5

A convenient method for the determination of the absolute intensities of Bragg X-ray reflections from a crystal from the relative intensity data is outlined. The method is applied to the case of the para-dinitrobenzene crystal as an illustration. It is believed that the error in the method lies in the range 5-20%. A more detailed account, including the method of correcting for the effect of small heavy atoms, will be presented elsewhere.

1786 Exploratory Investigations of the Properties of Synthetic Rutile Single Crystals by S Zerfoss and R G Stokes. Naval Research Laboratory Report NRL-P-3398 Dec 30 1948 9p

Single crystals of TiO_2 show a very high dielectric constant in a slightly reduced state and semiconductor properties when further reduced. Both the color and electrical characteristics are found to vary with the proportion of oxygen to titanium in the lattice. To determine the effect on dielectric constant and resistivity, a series of reductions was undertaken on a number of single crystal specimens. Limited reduction increases the dielectric constant by 10^2 and decreases the resistivity by 10^4. Longer exposure to hydrogen produces a semiconductor. The accompanying color shift during reduction progresses from near colorless through blue to opaque black. Crude efforts to measure rectification of single rutile crystals show front-to-back ratios of the order of 100 to 1. Preliminary indications are that reduced rutile crystals may have application as impedance-matched rectifiers, crystal triodes, or waveguide terminators.

DEUTERIUM AND DEUTERIUM COMPOUNDS

1787 A Study of the Influence of Deuterium Oxide (D_2O) on Growth (Beitrag zur Wirkung von Deuteriumoxyd (D_2O) auf das Wachstum) by B Cagianut Experentia 5 48-50 (1949) (In German)

The influence of different concentrations of heavy water (D_2O) on cultures of connective tissue of rabbit was studied. Low concentrations cause a lowering of the mitotic coefficient. Medium concentrations have a retarding effect on the rate of mitosis. Higher concentrations lead to the production of round-cells, nuclear pyknosis, and destruction of cells. An attempt is made to explain these effects on the basis of its aberrant physical properties.

FLUORINE AND FLUOROCARBONS

1788 The Electrochemical Process for the Production of Fluorocarbons by J H Simons and Coworkers Electrochem Soc J 95 47-52 (1949) Feb

A direct electrochemical method for the preparation of fluorocarbons in which elementary fluorine is neither produced nor employed is described in the 5 parts of this article. All previous methods for producing these substances involved the use of elementary fluorine either through direct reaction with carbon or carbonaceous substances or in the preparation of intermediate metal fluorides such as CoF_3 or AgF_2. This process consists of passing an electric current through a simple one-compartment cell containing an electrically-conducting hydrogen fluoride solution and an organic compound or compounds. In some cases the organic compound forms an electrically-conducting solution but in others, as for example hydrocarbons, addition of a third substance to impart conductivity enables the process to be used. The products are isolated from the cell gases or are drained from the bottom of the cell depending on their boiling points.

1789 The Refining of Fluorocarbons, January 1943 - March 1944 by N F Sarsfield. BR-527A nd 24p

An account is given of the processes developed at the Runcorn Laboratories for the refining of fluorocarbons with the formulae C_7F_{14} and C_7F_{16}. Much of the information may be taken to apply also to fluorocarbons of high molecular weight. The aim of the work was twofold, namely, the production of pure fluorocarbon of molecular weight 350 and to provide data for the eventual plant scale production of these substances. Refining has been found to involve three stages (1) aqueous extraction, (2) alcohol extraction and (3) distillation. An investigation of azeotropism between the fluorocarbons and the starting materials showed the necessity for stage (2). A description is given of the equipment developed for refining 3 kg per day of crude fluorocarbon.

GEOLOGY AND GEOPHYSICS

1790 Comparison of Age with the Relative Abundance of Argon and Potassium in Rocks by R L Farrar Jr and George H Cady J Amer Chem Soc 71 742-743 (1949) Feb

A study of several rocks of known geologic age was made in order to test the proposal of Thompson and Rowlands [Nature 152 103 (1943)] that the accumulation of argon resulting from decay by K-electron capture of K^{40} should serve as a measure of the age of rocks containing potassium. The analyses made indicate no regular increase of the A/K ratio with age. A careful isotopic analysis would be required to establish the relative proportions of argon formed by the decay of K^{40} and that originated from some other source, perhaps the atmosphere.

1791 Lead Isotopes and the Age of the Earth by Arthur Holmes Nature 163 453-456 (1949) Mar 19

The author comments on two statistical methods recently suggested by Jeffreys [Nature 162 (1948)] as a means of estimating the age of the earth. One of the methods is described as being wrong in principle and internally inconsistent, whereas the other method, although stated incorrectly, is correct in principle (according to the author). The author justifies basing his calculations on the abundances of Pb^{206} and Pb^{207} and traces the origin of the alleged discrepancies to which Jeffreys objected. Extensive calculations of the age of the earth, using data from various sources, are tabulated and discussed, and the methods and results are compared with those of Jeffreys. The author notes that many more isotopic analyses of old leads will be necessary to improve his estimate of about 3300 million years appreciably.

HEALTH PROTECTION

1792 Radiation Hazard Control by Argonne National Laboratory. AECU-168 (ANL-4146) May 3 1948 60p

The purpose of this manual is to acquaint personnel with the hazards involved and the precautions which should be taken in handling radioactive materials. Among the topics discussed are the permissible exposures for both external and internal radiations, precautions to be observed in handling radioactive materials, and general safety and emergency procedures.

1793 Beryllium — Health Hazards in the Extraction of Beryllium Oxide from Beryl and Beryllium Alloy Manufacture — by Joseph Shilen, Joseph F Mellor Jr, Fred B Koppenhaver, John G Cleland, A E Galloway, and Lewin R Lutz Ind Med 18 109-113 (1949) Mar

Evidence is presented of exposure to beryllium fluoride dusts in the extraction of beryllium oxide from beryl (a beryllium alunimum silicate) without any dispensary records for the past 2 years for respiratory illness except one. This man had a 28-year history as a foundry worker before employment at the plant investigated. He complained of shortness of health and upon examination was found to have cardiac disease.

1794 Radiological Safety Regulations. Navy Department Bureau of Medicine and Surgery Dec 1947 95p (NP-622)

These regulations, established by the Bureau of Medicine and Surgery, are designed to meet the requirements of the overall Radiological Safety Program of the Navy, particularly in connection with the utilization of atomic energy. The following subjects are covered: radiological hazards, tolerances, personnel requirements, medical examinations, photographic dosimetry, protection of personnel, general radiological safety regulations, special regulations for ships and material contaminated by atomic bomb tests, storage, handling and shipment of radioactive materials, miscellaneous radiological reports required by the Bureau of Medicine and Surgery, first aid, and safety indoctrination. Appendexes include AEC and ICC regulations.

1795 Surveying and Monitoring of Radiation from Radioisotopes by G W Morgan Nucleonics 4 No. 3 24-37 (1949) Mar

This paper, which is limited to the isotopes emitting β- and γ-radiation, discusses the following topics: measurement of radiation, techniques in surveying, and survey of laboratory operations.

INSTRUMENTS

1796 A New Horizontal Electron Microscope by N N Das Gupta, M L De, D L Bhattacharya and A K Chaudhury Indian J Phys 22 497-513 (1948) Nov

A historical summary of the development of the electron microscope is presented by the authors preliminary to a discussion of the construction of a new horizontal electron microscope which has several features which distinguish it from its predecessors. One interesting advantage which this instrument affords the researcher is a high degree of flexibility; this results from the horizontal alignment of the different elements, which are mounted on two steel rods in such a manner that any portion can be dismantled or an additional element can be interposed between any of the standard elements, without disturbing other parts of the apparatus. This arrangement also makes each element of the apparatus approachable from all sides. Detailed descriptions and drawings of the illuminating system, specimen chamber, lenses, photographic unit and electronic control circuits (voltage supplies, current regulators, vacuum gauge, and relay circuits) are given. The microscope can be operated at a maximum electron energy of 80,000 electron volts and is designed for an electron optical magnification of twenty thousand diameters.

ISOTOPES SEPARATION

1797 Cascade Theory by Hartland S Snyder Phys Rev 75 906-907 (1949) Mar 1 (Letter to editor)

The author justifies the use of graphical interpretation methods and the fact that the solution of the diffusion equations obtained in an earlier paper [Phys Rev 53 960 (1938)] did not satisfy the correct boundary conditions. Both criticisms have been advanced by Bhabha and Chakrabarty [Phys Rev 74 220 (1937)]. In a paper to be published a solution will be given which does satisfy the correct boundary conditions and which can be reduced to the forms given by Bhabha and Chakrabarty.

1798 The Szilard - Chalmers Reaction and Related Papers by K Shafer. National Research Council of Canada Report CI-166 nd 30p

In this bibliography, abstracts are given for the various references listed.

NEUTRONS

1799 Charged Particles Emitted by Carbon Bombarded by 90 Mev Neutrons by Keith Brueckner and Wilson M Powell. AECU-169 (UCRL-296) Feb 23 1949 6p

Secondary charged particles emitted from carbon nuclei bombarded with 90-Mev neutrons have been measured in a series of cloud chamber experiments. Protons with energies from 32 to 107 Mev, deuterons from 25 to 124 Mev, and tritons from 56 to 95 Mev could be identified with very small uncertainty in the type of particle and about a $\pm 6\%$ probable error in energy. The angular range from 0° to 36° was included, with a probable error of about $\pm 2°$ in angle. The cross section for the production of the particles observed is 24 ± 12 millibarns.

1800 Absolute Cross-section for the Capture of Neutrons of 200 and 900 keV Energy by L E Beghian and H H Halban Nature 163 366-367 (1949) Mar 5 (Letter to the editor)

The capture cross-sections of the following isotopes for 900-Kev neutrons were determined by Measuring the ratio of their β-activities to that of manganese when irradiated by a radiothorium-beryllium photo-source in air: Al^{28}, Mn^{56}, Cu^{66}, As^{76}, $Pd^{107,109}$ Pd^{111}, Ag^{108}, In^{116}, Sb^{122}, I^{128}, Ba^{130}, Te^{131}, W^{187}, Pt^{199}, Au^{198}. By using these results in conjunction with those of Allen et al [Nature 161 727 (1948)], the cross-sections for 200-Kev neutrons were obtained directly. The data which are given in tabular form indicate that the cross-sections of nuclei of comparable mass number show considerable differences. The general tendency of the cross-section to increase with increasing mass number predicted by various theories is not as marked as would be expected. The authors conclude that a marked contradiction exists between existing qualitative and quantitative theories on the one hand, and experimental facts on the other hand, and although only a few nuclei show marked deviations from the general trend, existing theories do not allow for such variations.

1801 Coincidence Measurement of Neutron Energy by Donald C Worth Phys Rev 75 903 (1949) Mar 1 (Letter to the editor)

A technique for measurement of neutron energy has been developed in which use is made of a coincidence-absorption arrangement. Protons which originate as recoils from the incident neutrons in a hydrogen-filled proportional counter pass after a variable amount of absorption into a second proportional counter. A plot of coincidence rate as a function of absorption gives the extrapolated range and energy of the scattered protons and hence of the neutrons. The method was applied to the $H^2(d,n)He^3$ reaction which was chosen for its homogeneous neutron yield. A curve of the normalized coincidence rate as a function of the total absorption is shown; the Q-value determined from the extrapolated range is 3.08 ± 0.18 Mev.

NEUTRONS (continued)

1802 Laplace Transform Solution of Two-medium Neutron Ageing Problem by R Bellman, R E Marshak and G M Wing Phil Mag 40 297-308 (1949) Mar

The Laplace transform solution of the two-medium neutron ageing problem is developed for a point source of monoenergetic fast neutrons situated at a given height above the interface between two semi-infinite plane media of different slowing down properties. It is assumed that Fermi's age theory [Ricerca Sci 7 13 (1936)] holds for both media. The authors' note that the equation obtained together with the initial conditions and the boundary conditions are formally equivalent to another physical problem, i.e., given a point source releasing a pulse of heat in the presence of two semi-infinite substances of different densities and diffusivities, what are the temperatures if the two media as a function of the time? When the Laplace transforms are used, the equations obtained are formally identical with those occurring in the Sommerfeld theory of the effect of a finitely conducting plane upon the radiation of an oscillating dipole. Using the methods of Sommerfeld and of Stratton solutions are obtained in a form which is simplified to facilitate computations.

1803 Neutron Yield from $Li^7(p,n)Be^7$ by G Freier, E E Lampi and J H Williams Phys Rev 75 901-902 (1949) Mar 1 (Letter to the editor)

Since the reaction $Li^7(p,n)Be^7$ is used extensively as a monochromatic source of fast neutrons, the yield from the threshold, 1.88 Mev to 3.66 Mev has been studied to determine whether there exists more than one group of neutrons. It has been reported [Hill and Shoupp, Phys Rev 73 931 (1948)] that a resonance occurs at 3.06 Mev with the possibility that this is due to an excited state of Be^7. A curve for the neutron yield at 0° and 90° as measured with a flat energy response detector is shown. A curve of this ratio is relatively smooth and hence it is concluded that to within the accuracy of the measurements, there is only one group of neutrons emitted for proton energies up to 3.66 Mev.

1804 The Number of "Fast" Neutrons Emitted from a (Ra-α + Be) Source by F G Houtermans and M Teucher Z Physik 124 700-704 (1948) (In German)

The number of neutrons above the fission threshold energy of U^{238} emitted by a (Ra-α +Be) source was found to be 3800 $\pm$ 1000 per sec per mC, i.e., about 50% of all neutrons emitted. The experiments were made using an ionization chamber, lined with U_3O_8, which was connected to a linear amplifier having a resolving time of approximately 1 μ sec.

1805 On the Scattering of Fast Neutrons by Non-Central Interaction by B Holmberg University of Lund, Dissertation (1948) 31 p (In English)

The analysis of n-p scattering by ordinary methods and using the S-matrix formalism are given and are shown to give the same results. Expressions are derived for small phases which correspond to Born's approximation in the simple case of a central interaction. Numerical integration is used for the triplet state so that calculations for larger phases can be made. Cross-sections are obtained for the Hulthuen mixed scalar-pseudoscalar non-symmetrical theory at 11.2 and 17.4 Mev for two choices of the pseudo-scalar coupling constant. For one of the values the total cross-section agrees well with experiment, but there is strong forward scattering, and the quadrupole moment is incorrect.

1806 Scattering of High Energy Neutrons by Protons with Non-Central Interaction by K N Hsu and T M Hu Phys Rev 75 987-988 (1949) Mar 15 (Letter to the editor)

Calculations have been made for the scattering of high energy neutrons by protons, assuming a non-central interaction and Yukawa and exponential well types of potential. The calculations have been made for 83-Mev neutrons, assuming a range of 2.8×10^{-13}cm. Curves are shown for the differential cross section as a function of the angle of scattering in the center of mass system for Yukawa, exponential and spherical well potentials, for both symmetrical and exchange interactions. The angular distribution is found to vary considerably with the shape of the potential well. The total cross section is not sensitive to the shape of the well provided a reasonable range is chosen and the values for the total cross sections obtained for all well shapes and both interaction-types are much larger than the empirical values.

NEUTRONS (continued)

1807 The Scattering of Slow Neutrons by Paramagnetic Crystals by I W Ruderman, W W Havens Jr, T I Taylor and L J Rainwater Phys Rev 75 895-896 (1949) Mar 1 (Letter to the editor)

This article is based on AECD-2462. An abstract of AECD-2462 bearing the number AECD-2417 appeared in Nuclear Science Abstract as Abstract No. 2-525.

NUCLEAR PROPERTIES

1808 The Possibility of Differences in the Magnetic Susceptibilities of Stable Isotopes by Charles C Sterett. AECU-174 (Y-363) Feb 1 1949 22p

The modern theories of dia-, para-, and ferromagnetism show that differences in the magnetic susceptibilities of stable isotopes are possible only through an effect of the neutron number differences on the electronic energy levels. That this effect could result from a redistribution of the nuclear electrostatic field as well as a change in gravitational attractions is mentioned. The probability of detecting a difference appears much greater in the ferromagnetic elements, since their susceptibilities depend in a very critical manner on the inter-atomic spacing in the crystal. The knowledge of ferromagnetics indicates that a small isotopic difference in the lattice constant of Fe or Ni would cause a measurable difference in the saturation magnetization; the necessary difference appears to be of the order of .01 A. The determination of the magnetization curves and the hysteresis loops for the isotopes of Fe, Ni, and Gd is strongly recommended, both as the most reasonable approach to the search for isotopic susceptibility differences and as a means of investigating the effect of neutron number differences on electron configurations. This paper is the result of a study undertaken to estimate the possibility of finding susceptibility variations in stable isotopes and to acquire a knowledge of the fundamental theory.

NUCLEAR TRANSFORMATION

1809 Several Related Mathematical Problems in Bombardment Chemistry and in Other Fields by O C Simpson. AECU-176 (ANL-4203) Feb 18 1948 18p

Equations useful in problems involving the production of radioactive isotopes by pile or other radiations have been developed. As a result, the author has been brought to a point of view which to him seems very much simpler than the usual method of approach in deriving the appropriate yield equations. No claim is made that the point of view is original, or that any new problems have been solved. In particular, the method of approach appears to be a little more physical than the usual mathematical treatment of solving systems of differential equations. The following problems are used to illustrate the method: constant rate of production of a radioactive isotope, constant rate of production and $\lambda\tau_B \ll 1$, production of radioisotopes when pile power fluctuates in a stepwise manner, case where the product of neutron capture decays to a radioactive nucleus, electromotive force applied to an LR or RC series circuit, square wave voltage pulse in an R-L series circuit, molecular beam detection.

1810 Electro-Disintegration of Nuclei by J S Blair Phys Rev 75 907-908 (1949) Mar 1 (Letter to the editor)

The relative activities from electro-disintegration and photo-disintegration obtained in recently reported experiments [Skaggs et al Phys Rev 73 420 (1948)] in which the electron beam from the 22-Mev betatron activated a stack of thin foils have been calculated more accurately. The calculated and theoretical curves of the function (which involves only the initial and final energies of the electron and the kind of transition to an excited level) are compared for the electric dipole, magnetic dipole and electric quadrupole cases. The results, tentatively, appear to indicate that electric dipole transitions do not predominate.

NUCLEAR TRANSFORMATION (continued)

1811 Nuclear Capture of L_I Electrons by B Pontecorvo, D H W Kirkwood and G C Hanna Phys Rev 75 982 (1949) Mar 15 (Letter to the editor)

The previously reported L-capture phenomenon [Phys Rev 74 497 (1948)] has been studied in detail using proportional counters filled with various gases and traces of A^{37}. Tabulated data for argon and xenon fillings of two different counter types are shown. Nuclear capture of L electrons should result in the liberation in the counter of an energy equal to the L ionization potential. Such a low energy peak at about 1/10 of the energy of the main peak, has been observed using counters with "argon" fillings. Some reasons why the presence of a low energy peak should not in itself be considered as a proof of L orbital electron capture are presented, and the authors justify their interpretation of the data as constituting proof of L-capture. The values for the L_I peak as well as the value for the (L_I, L_{II}, L_{III}) peak, correspond to an energy smaller than the theoretical value. This is due in part to an increase in the mean energy necessary to produce an ion pair at low energy, and in part to a distortion of the shape due to an "end-effect tail." In estimating the relative probability of L-capture as compared with K-capture, a value of 8 to 9% is obtained as compared with the theoretical value of 6%.

1812 On the Diffusion of Transmuting Particles (O diffusii transmutiruyushchikh chastits) by N S Akulov Doklady Akad Nauk SSSR 61 235-238 (1948) July 11 (In Russian)

This is a continuation of a theoretical study outlined in Doklady Akad Nauk SSSR 56 No. 7 (1947) and in Vestnik Moskovskogo Univ No. 2 (1948). The case is investigated of particles diffusing into a substance and, through interaction with the latter, undergoing transmutation into particles with new properties. In the process of diffusion, the new particles may undergo further transmutations. Consecutive, cyclic, or chain types of processes are possible. The processes are viewed as diffusion waves transmuting into each other; a formula is derived giving the velocity of these waves.

1813 Upper Limit for the (d, H^3) Reaction in Phosphorus by David Kahn and Gerhart Groetzinger Phys Rev 75 906 (1949) Mar 1 (Letter to the editor)

A search for the reaction P^{31}(d, H^3) has been repeated by bombarding elemental red phosphorus for periods of 1 minute with 7.5-Mev deuterons with an arrangement which would allow the detection of this process if the cross section were larger than $5 \times 10^{-30} cm^2$. Using a magnetic field to separate the positive and negative electrons only a positron radiation of approximately 72-second half-life was observed after bombardments. The only observed activity was that due to the oxygen impurity. Assuming a cross section of $1 \times 10^{-26} cm^2$ for the O^{16}(d,n)F^{17} reaction [Newson, Phys Rev 51 620 (1937)], and assuming that a P^{30} activity one-tenth as strong at the end of the bombardment could have been detected the above mentioned upper limit can be given.

1814 Yields of Some Photo-Nuclear Reactions by M L Perlman Phys Rev 75 988-989 (1949) Mar 15 (Letter to the editor)

Further work has now been done with (γ,n) reactions in the vicinity of mass number 60 where it has been previously shown that a transition occurs in the relative yield values [Phys Rev 74 442 (1948)]. Measurements have been made also on two additional (γ,n) reactions in heavy elements. Incidental to this work, data on two other reactions have been obtained. The data for the Cr, Fe, and Ni(γ,n) reactions would make it seem that the increase in the (γ,n) yields in the vicinity of mass number 60 occurs over a range of mass numbers perhaps as great as 15. The yield for the only (γ,pn) reaction investigated, i.e., Ge^{70}(γ,pn)Ga^{68}, is of the same order of magnitude as the (γ,p) yields.

PARTICLE ACCELERATORS

1815 Azimuthal Variations of the Betatron Field by W B Lasich, E G Muirhead and I F Wright J Sci Instruments 26 91-92 (1949) Mar

The azimuthal variations in the out-of phase fields of a 3 Mev betatron have been measured using apparatus of improved sensitivity. The method is described and the out-of-phase field analysed giving the contributions from inhomogeneities in the iron, eddy currents between laminations and eddy currents in the laminations themselves. Also a structural steel clamping frame is shown to have a negligible effect on the field.

PARTICLE ACCELERATORS (continued)

1816 The High-Voltage Electrostatic Generator at the Atomic Energy Research Establishment by R L Fortescue and P D Hall Proc Inst Electrical Engrs 96 Part 1 77-85 (1949) Mar

A 5-MV electrostatic generator of the pressurized Van de Graaff type is described. The basis of the design follows that of a recent machine built in America, and the factors leading to this design are discussed. The gas pressure chosen was up to 400 lb/in^2, and the size of the pressure tank is approximately 16 ft long by 6 ft diameter. Details of the construction are given, and the results of trials are reported. The rated output of 300 μA was obtained and a maximum open-circuit voltage of just over 5 MV. This required the use of nitrogen-CCl_2F_2 mixture as insulating gas and the subdivision of the air-gap between the 30-in terminal and the pressure-vessel wall by the use of electrode shields. Using pure nitrogen and no shields the maximum voltage was little more than 2 MV. With positive terminal polarity, gas pressure in excess of 200 lb/in^2 gave no improvement in open-circuit voltage. The voltage stability of the generator is discussed.

PERIODIC TABLE

1817 An Attempt at a Periodic Arrangement of Elements on the Basis of the Structure of the Atom Nucleus (Opyt periodizatsii elementov na osnove stroeniya atomnogo yadra) by I A Weissman Doklady Akad Nauk SSSR 62 211-214 (1948) Sept 11 (In Russian)

Isotopes having the same isotopic number I = A - Z are placed on the same horizontal line, those belonging to the same element being placed vertically down in the order of increasing I. The periodic system presents then several similar bands consisting of horizontal and down-sloping segments: for the lightest isotopes of 2 neighboring odd (or 2 neighboring even) elements, $I_2 - I_1 = 0$ in the horizontal segments, and $I_2 - I_1 = 2$ in the down-sloping segments; the same is true for the heaviest, and for the intermediate isotopes. The table includes all stable and naturally-radioactive nuclei, excepting the short-lived β-emitters. Empty places in the table correspond to those unstable isotopes which have disappeared during the evolution of the elements, or still exist in small quantities and may yet be discovered with greater or smaller probability (indicated on the table). The rules observed suggest a picture of the nucleus as consisting of a central group of neutrons (A-Z) and a peripheral group of neutrons and protons.

1818 Further Regularities in the System of Isotopes (Dal'neishie zakonomernosti v sisteme isotopov) by M A Levitskaya Doklady Akad Nauk SSSR 60 45-46 (1948) Apr 1 (In Russian)

In Doklady Akad Nauk SSSR 55 309 (1947) the author presented certain rules governing the position of isotopes in the periodic system. Here some further regularities are shown concerning the differences existing between elements whose atomic numbers exceed the value 32, and the remaining elements in the table.

PHYSICS, GENERAL

1819 References on Voltage Regulation and Corona Discharge by F E Croxton. AECU-181 (KZ-676) Mar 29 1949 21p

This is an alphatical listing of papers and books concerning voltage regulators, regulation, and corona discharge covering the period 1941 - 1948. Brief content notes are given for some references.

1820 Electron Emission Produced in Thin Layers of B_2O_3 through Bombardment with Positive Ions (Elektronnaya emissiya tonkikh sloev B_2O_3 pri bombardirovke polozhitel'nymi ionami) by S V Starodubtsev Doklady Akad Nauk SSSR 62 765-766 (1948) Oct 21 (In Russian)

A thin layer of a dielectric on a metal substratum, when bombarded by electrons, becomes a source of an electron emission. This phenomenon has been studied repeatedly since its discovery by Malter [Phys Rev 49 378 (1936)]. It is attributed to the positive charge created on the dielectrics surface. In order to produce this charge in a more direct way, the author bombarded the dielectric with positive ions. In a high vacuum, an incandescent W filament bearing powdered B_2O_3 served as a source of positive ions and as an evaporator for the formation of dielectric films on a Ni collector. Through a slit in the collector the ions passed onto a second collector, and, through a slit in the latter,

PHYSICS, GENERAL (continued)

into a mass analyser. The ions were mainly K^+ (from impurities). The current in the first collector increased gradually with the growing thickness of the film, then underwent a sudden large increase when the thickness was about 2.10^{-4}cm. If after that the heating of the filament was interrupted, the current persisted: it was now determined by the electrons emitted by the film. According to the author's interpretation, the positive charge on the surface of the dielectric creates a strong field which pulls electrons out of the underlying metal. When a certain thickness of the dielectric is reached, these electrons are able to ionize atoms in the dielectric, thus increasing the positive charge of the latter.

1821 Heat Transfer from High-Temperature Surfaces to Fluids. I. Preliminary Investigation with Air in Inconel Tube with Rounded Entrance, Inside Diameter of 0.4 Inch and Length of 24 Inches by Leroy V Humble, Warren H Lowdermilk and Milton Grele. National Advisory Committee for Aeronautics Research Memorandum NACA-RM-E7L31 May 21 1948 29p

The investigation was made over a range of Reynolds numbers up to 250,000 and a range of average inside-tube-wall temperatures up to 1240° F. The corresponding maximum local tube-wall temperatures ranged up to 1500° F. Correlation of the heat-transfer data by the conventional method wherein physical properties of the air were evaluated at the average bulk temperature resulted in a reduction of Nusselt number of about 25 percent for an increase in average surface temperature from 220° to 1240° F at constant Reynolds number. A good correlation of the data for the entire temperature range was obtained, however, when the physical properties of the air were evaluated at the average surface temperature and the Reynolds number was modified by substituting the product of air density evaluated at the average surface temperature and velocity evaluated at the average air bulk temperature for the conventional mass flow per unit cross-sectional area. Static pressure drops were obtained for all operating conditions and were satisfactorily correlated with air flow rate and the ratio of entrance-to-exit density.

PHYSICS, NUCLEAR

1822 Proceedings of the American Physical Society Phys Rev 75 325-349 (1949) Jan 15

The 287th meeting of the American Physical Society was held in Chicago on November 26 and 27. Abstracts of most of the numerous papers presented are given.

The following papers concerned with topics related to nuclear physics were presented: Excited States of Nuclei by M Goldhaber; Phenomenological Quantum Electrodynamics by J M Jauch; Nuclear Resonance Line Widths as Functions of Temperature by G E Pake; Neutrons Correlated with Charged Cosmic-Ray Particles by R D Sard; Recoils from Neutrino Emission by C W Sherwin; Excitation of Nuclei by X-Rays and Electrons by Bernard Waldman; Study of New Elements by X-Ray Diffraction Methods by W H Zachariasen; Absolute Determination of the Emission Rate of Beta-Rays by R K Clark and G Failla; Shape of the Beta-Spectrum of RaE by Lawrence M Langer; Screening and Relativistic Effects on Beta-Spectra by C Longmire and H Brown; A New Radioactive Isotope of Oxygen by R Sherr, H R Muether and M G White; The Radioactive Decay of K^{40} by J J Floyd, C D Coryell and L B Borst; Disintegration of Mn^{54} into the Isobar Fe^{54} by J D Kurbatov and Donald Gideon; An Investigation of Bremsstrahlung by Means of the Nuclear Isomerism of Indium by Walter C Miller and Bernard Waldman; Nuclear Isomerism of Selenium Produced by X-Rays by D N Gideon, W C Miller and B Waldman; Radiations from Cd^{115} and $*In^{115}$ by C E Mandeville, M V Scherb and W B Keighton; The Beta- and Gamma-Radiation of Ta^{182} by Louis A Beach, Charles L Peacock and Roger G Wilkinson; The Radiations of W^{187} and Au^{199} in the Low Energy Region by Charles L Peacock and Roger G Wilkinson; The Gamma-Rays Following Au^{198} β-Decay by D Saxon and R Heller; Survey of Nuclear Energy Possibilities by Cecil B Ellis; Nuclear Reactor at Brookhaven National Laboratory by Lyle B Borst; Betatron Model by D W Kerst, G D Adams, H W Koch, and C S Robinson; Low Energy Radiations in Proportional Counters by G C Hanna, B Pontecorvo and D H W Kirkwood; Temperature Dependence of Efficiency of a Naphthalene Scintillation Counter by R S Claassen and R W Boom; A New Proton Spectrometer by

PHYSICS, NUCLEAR (continued)

E M Hafner, W F Donoghue and H Snyder; On Making Thin Nylon Films by J Richards, J Brown, F Felber, and D Saxon; Packing Fractions of the Nickel Isotopes by A E Shaw; On the Origin of the Elements by R A Alpher, R C Herman and G A Gamow; Principle of Regularity and Continuity of Nuclear Series by Williams D Harkins and Martin Popelka, Jr.; An Interpretation of Nuclear Shell Structure by Eugene Feenberg and Kenyon C Hammack; Consequences of Generalized Meson Field Theories by Alex E S Green; Fluctuations in Energy Loss of Fast Charged Particles Passing through Matter by K R Symon; The Intrinsic Efficiency of Fluorescence Excited by Electron Bombardment by R L Longini; Angular Yield of Neutrons from the D-D Reaction by G T Hunter and H T Richards; P-N Threshold for Deuterium by R V Smith and H T Richards; Angle Dependence of the Reaction $Li^6(d,p)Li^7$ by R W Krone, S S Hanna and D R Inglis; Absolute Measurement of the $Li^7(p,n)$ Threshold Voltage by W E Shoupp, B Jennings, W Jones and M Garbuny; Total Cross Section of Be, N, O, Na, and Ca for Fast Neutrons by C K Bockelman, R K Adair, H H Barschall and O Sala; The Gamma-Ray Spectrum from $F^{19} + H^1$ Using Photographic Emulsions Containing D_2O by Gerson Goldhaber; P-N Reactions for Argon and Neon by H T Richards and R V Smith; $(p,n):(p,\gamma)$ and $(d,n):(d,2n)$ Reaction Cross Sections by Using Enriched Mo by D N Kundu and M L Pool; Relative Cross-Section Measurements for the Identification of Tc^{92} and Tc^{93} by M L Pool and D N Kundu; Light-Charged Particle Emitted in Fission by K W Allen and J T Dewan; The Distribution of Nuclear Charge in Fission by C D Coryell, L E Glendenin and R R Edwards; Nuclear Closed Shell Effects in Fission by L E Glendenin; Quantum-Electrodynamics by Frederik J Belinfante; Radiative Correction to the Klein-Nishina Formula by David Feldman and Julian Schwinger; The Magnetic Internal Conversion Coefficient by S D Drell; The Equation of State as an Eigenvalue Problem by Joseph W Weinberg; Charged Bose-Einstein Particles in a Magnetic Field by M F M Osborne; Transport Phenomena in an Ideal Bose-Einstein Gas by William Band; Pretreatment of Nuclear Emulsions for Cosmic-Ray Exposures by Herman Yagoda and Nathan Kaplan; Absorption of the Hard Component of the Cosmic Radiation in the Stratosphere by Marcel Schein, Victor H Yngve and Theodore Bowen; Observations on Heavy Nuclei in Cosmic Radiation by E P Ney, P Freier, E J Lofgren and F Oppenheimer; Star Production at High Altitudes by P S Freier, E J Lofgren, E P Ney and F Oppenheimer; The Origin of Large Cosmic-Ray Bursts at an Altitude of 3500 Meters by E F Fahy and Marcel Schein; Note on the Light-Particle Hypotheses of Penetrating Particles in Extensive Cosmic-Ray Showers by K Sitte; Production of Neutrons by the Capture of Cosmic-Ray Mesons by Gordon W McClure and Gerhart Groetzinger; Nuclear Disintegrations and Mesons in the Stratosphere by Jere J Lord and Marcel Schein; On the Decay Products of the μ-Meson by E P Hincks and B Pontecorvo; Diurnal and Seasonal Variation in Frequency of Occurrence of Small Cosmic-Ray Bursts by R M Whaley and V A Long; Relation of the Cosmic Radiation to Sunspot Magnetic Moments by James W Broxon; Some Calculations Concerning Neutron-Proton Scattering by J M Blatt and J D Jackson; Electrostatic Scattering of Neutrons by S M Dancoff and S D Drell; Angular Distribution of 14-Mev Neutrons Scattered by Protons by H H Barschall and R F Taschek; Consideration of Multiple Scattering in the Evaluation of Cloud-Chamber Tracks by Martin Berger and Gerhart Groetzinger; Cloud-Chamber Tracks of Positive Particles Branching from Beta-Rays by Gerhart Groetzinger, Fred Ribe and Lloyd Smith; Angular Distribution of 1- to 3.5-Mev Protons Scattered by He^4 by George Freier, Eugene Lampi, W Sleator and J H Williams; On the Scattering of Fast Neutrons by H Feshbach and V F Weisskopf; Polarization of d-d Neutrons by Lincoln Wolfenstein; Double Refraction and Polarization of Neutron Beams by Otto Halpern; The Hyperfine Structure of Tritium by Edward B Nelson and John E Nafe; Magnetic Refraction of Neutrons at Domain Boundaries by D J Hughes, M T Burgy, R B Heller and J W Wallace; Photoelectric Determination of the Fermi Level at Surfaces of Amorphous Arsenic by E Taft and L Apker; Correlation of Geiger-Counter and Hall-Effect Measurements in Alloys Containing Germanium and Radioactive Antimony 124 by G L Pearson, J D Struthers and H C Theuerer; A Double Focusing Mass Spectrometer by Alfred O Nier, T R Roberts and E G Franklin; Measurement of Electron Mobility by Means of Pulse Techniques by F F Rieke and Daryl Errett; On the Characteristics of the Parallel Plate Spark Counter by Leon Madansky and R W Pidd; Magnetic Scattering of Elementary Nucleons by Joseph W Weinberg; The Masses of the Mesons by Enos E Witmer; Difference in the E-W Asymmetry of the Hard Component of the Cosmic Radiation for Particles of Opposite Charge by Gerhart Groetzinger and Gordon W McClure; Nuclear Magnetic Moments as Integral Multiples of a Natural Unit by Enos E Witmer.

PHYSICS, NUCLEAR - METHODS OF MEASURING

1823 The Ten Channel Electrostatic Pulse Analyzer by D A Watkins. AECU-175 (LAMS-856) Feb 14 1949 20p

A ten channel pulse height discriminator using a beam deflection tube is described. The instrument provides one volt channels and has a high degree of stability. Essential circuits are given so that the analyzer may be readily duplicated. Performance and limitations are discussed.

1824 The Construction and Performance of a High Pressure Condenser Ionization Chamber by F W Spiers Brit J Radiology 22 169-172 (1949) Mar

A condenser ionization chamber has been constructed for the purpose of measuring weak γ-radiation having an intensity of the same order as that of the general background radiation. Scale drawings of the chamber and details of its electrode assembly are shown. The chamber was designed for pressures up to 80 atmospheres. When operating at 78 atmospheres, the chamber seal was such that only 2 atmospheres of the pressure was lost over a nine-month period. Tabulated data for the response of the chamber to radiations from various sources are given in terms of response above the background and curves of the sensitivity of the chamber as a function of chamber pressure are also shown. A gradient of about 1.5% per 100 volts at pressures of 48 and 78 atmospheres is indicated. It is also noted that if the pressure is raised to 78 atmospheres, the background response is increased only by a factor of 4 as compared with an increase by a factor of 20 in the response to the γ-radiation. The minimum radium content which can be measured is of the order of 5×10^{-3} μ gm and the possibility of using the chamber to determine the activity of rock samples is suggested. The chamber is also very suitable for measuring scattered γ-rays from small samples of materials and measurements of this type to determine the electron density of excised tissues are now in progress.

1825 Discharge of a Geiger Counter at Voltages above the Plateau by H R Crane Phys Rev 75 985 (1949) Mar 15 (Letter to the editor)

The mechanism of the discharge of a Geiger counter at voltages above the plateau has been investigated. The average time between the raising of the voltage and the first discharge has been plotted as a function of the voltage (with constant resting period) and as a function of the resting period (for constant voltages of 1600, 2000, and 2300 volts). The results make it reasonable to suppose that in the region above the plateau, spurious discharges may be initiated by an after-emission of electrons or photons, due to activation of the surfaces or gas produced by the previous discharge, rather than by ionization produced directly by the application of the high voltage. Since the curves show that in some cases it requires seconds for the after-emission to die away, it does not seem possible to account for the effect on the basis simply of gas ions which fail to be collected during the resting period.

1826 High Multiplication Proportional Counters for Energy Measurements by G C Hanna, D H W Kirkwood and B Pontecorvo Phys Rev 75 985-986 (1949) Mar 15 (Letter to the editor)

The essentials of the technique of investigating L-capture [Phys Rev 75 982 (1949)] in the A^{37} and H^3 spectra [Phys Rev 75 983 (1949)] by means of proportional counters are described and the problems of linearity and "line-width" are discussed. The results obtained have been tabulated and plotted; they are found to be most consistent with a mean square deviation of "n", the estimated mean number of ion pairs released by radiation. Since less spread is introduced by the gas amplification than would be expected from the theory, an attempt is now being made to formulate a more accurate theory of the process.

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

1827 On γ-Spectroscopy Using Compton Electrons (O γ-spektroskopii po komptonovskim elektronam) by B T Dzhelepov and M L Orbeli Doklady Akad Nauk SSSR 62 615-617 (1948) Oct 11 (In Russian)

Most γ-spectra contain lines in the energy range 0.5-3 Mev. Since the maximum probability of the Compton effect belongs to these energies, it is convenient to use the Compton electrons for the study of the corresponding part of a γ-spectrum. The first application of this method was made by Skobel'tsyn [Z Physik 43 354 (1927)], who measured the energies of electrons from γ-rays of RaC in a Wilson chamber placed in a magnetic field. Latyshev [Zhur Eksptl i Teoret Fiz 14 65 (1944)] used a mass spectrometer and counter coincidences for the study of RaC and Th(C + C″) on samples having 300 mC activity. The present author's modifications of Latyshev's instrument (two points of intersection of the electron rays instead of one) permitted the use of considerably lower activities (15 and even 3 mC). Owing to the wide separation of the 2 counters, the cosmic-ray background was negligibly weak. The instrument's characteristics were: R = 5.5 cm, $\phi = 4°$, slit 1-8 mm, thickness of the celluloid target 50 μ. Two examples of γ-lines determined by this method are shown: the line 2620 Kev of ThC″ and the line 1708 Kev of Sb^{124}.

1828 Scintillation Counting with Chrysene by Edwin J Schillinger Jr, Bernard Waldman and Walter C Miller Phys Rev 75 900-901 (1949) Mar 1 (Letter to the editor)

Various organic phosphors have been investigated in order to extend the response range of scintillation counters to low energy β-particles. Chrysene was found to be at least as efficient as anthracene for crystals of comparable size and superior to anthracene with respect to ease of crystallization of relatively large size crystals. Counting rate curves as a function of bias are shown for chrysene, anthracene, and napthalene crystals; an uncollimated C^{14} source was used. Efficiency tests were also made on the β-rays of Co^{60}, but the efficiency of the chrysene counter was less than that of a G-M counter, unless the background was raised. The chrysene scintillation counter was used to detect the internally converted electrons from Rh^{103*} (about 40 Kev). A weakly activated sample (X-ray excited) gave counting rates slightly greater than twice background at an optimum bias setting.

PHYSICS, THEORETICAL

1829 Asymptotic Expansions of Coulomb Wave Functions by Milton Abramowitz Quart App Math 7 75-84 (1949) Apr

Asymptotic expansions for the Coulomb wave functions have been developed which should prove particularly useful to the nuclear physicist studying reactions involving collisions of charged particles. Reasonable accurate values of these functions are particularly necessary in the investigation of reactions involving light particles and should be of value, in particular, in proton-proton scattering studies which necessitate the extension of earlier results to include new parameter ranges.

1830 Čerenkov Radiation Effect in Meson Theory by W W Wada Phys Rev 75 981-982 (1949) Mar 15 (Letter to the Editor)

The concept of Čerenkov radiation is applied to the equations of a scalar meson in the hope of accounting for some instances of multiple meson production in a phenomenological way. The mesonic Čerenkov radiation is expected to occur if the source of the mesonic field, viz., the nucleon, moves with velocity greater than the phase velocity of the propagation of the meson field itself. In order to have the conditions necessary for the mesonic Čerenkov radiation, phenomenological field equations endowed with constants analogous to the ϵ and μ of Maxwellian theory have to be used. The Gordon-Klein equation is formed for the simplest case, i.e., that of a meson field, and an expression for the phase velocity of a meson wave in nuclear matter is obtained by assuming a plane wave solution to this equation. The significance and interpretation of the expression obtained are discussed.

PHYSICS, THEORETICAL (continued)

1831 Particles with Spin and the Principle of Reciprocity by Kai-Chia Cheng and Antonio E Rodriquez Nature 163 367-368 (1949) Mar 5 (Letter to the editor)

Following a suggestion by Born and Green, their theory of ultimate particles [Nature 163 207, 208, 320 (1949)] has been extended to the case of spin 1/2. The solutions obtained are expressed in the form of Laguerre polynomials from which the masses of the particles can be obtained. The condition for the prediction of the existence of neutrinos is noted and attention is called to the fact that it is likely that the same factor represents electrons as charged neutrinos. The predicted particle rest masses are shown in a diagram.

1832 Relativistic Field Theories by T S Chang Phys Rev 75 967-971 (1949) Mar 15

The study of the change of the Schroedinger wave functionals on space-like surfaces as the surface changes is formulated simply. In this formulation S represents any space-like surface with the curvilinear coordinates u; $\langle q(u)S|\rangle$ is introduced as the Schroedinger functional on it, with the nature of the functions q(u) not specified for the moment, and the Schroedinger equation becomes $\frac{1}{i}\left[\langle q(u), S'|\rangle - \langle q(u), S|\rangle\right] = J\langle q(u), S|\rangle$, (1) where S′ is a surface slightly different from S, and J is an operator operating on q(u) and depending on S,S′, and the choice of their coordinates u. The only necessary conditions for J are that J is Hermitian and that (1) is integrable. To get a theory resembling the existing ones, it is further required that if the expectation value of a certain field quantity is constructed at a point P from $\langle q(u), S|\rangle$, S being a surface passing through P; the expectation value is independent of the choice of S and its coordinates u, and satisfies certain differential equations.

An expression for J has been obtained by Weiss [Proc Roy Soc London 156 A 192 (1936)], which applies when these differential equations follow from the LaGrangian principle. The earlier work on this is given in its entirety and the proof that all the requirements are satisfied has been completed. Finally, from a simple transformation on the wave functions and the observables, Tomonaga's formalism [Prog Theoretical Phys 1 27 (1946)] has been deduced from the Weiss formalism. As a consequence, it is noted that the Tomonaga formalism results in essentially the same difficulties encountered when the orthodox Heisenberg-Pauli is used.

1833 The Statistics of Pure Cases in Wave Mechanics and the Interference of Probabilities (La statistique des cas purs en mécanique ondulatoire et l'interférence des probabilités) by Louis de Broglie Rev Scientifique 86 259-264 (1948) Mar 1 and 15 (In French) (Printed November 15, 1948)

Certain aspects of the statistical formalism of wave mechanics are presented which show that, if this formalism is to fit into the general frame of the probability calculus, a new mathematical statistics should be developed. This should be done by discarding certain too restrictive postulates and by introducing others, comprehensive enough to accomodate the statistical laws of microphysics which should now be regarded as reposing on a very sound experimental basis. The classical probability theory adopts, more or less tacitly, what may be called the "objectivity postulate": dealing with objects whose physical characteristics are independent of the manner employed for making a statement about them, the mathematical statistics accepts this independence as a general law, the immediate consequences of which is the liberty of making those statements in any order, or even simultaneously. The theorems of "total probabilities" and of "compound probabilities" of two variables are based on this postulate. In wave mechanics this formalism is not valid whenever the two variables are canonically conjugated magnitudes associated with non-commutable operators, (as, e.g. the coordinate and the momentum). The new mechanics postulates both the impossibility of a simultaneous measurement of such magnitudes and the influence of the result of the measurement of one of them on the probable result of the measurement of the other. Mathematically, this involves the representation of such probabilities by squares of the moduli of complex numbers and the replacement of the theorem of "compound probabilities" by that of the "interference of probabilities" whose physical significance is revealed in the existence of various interference phenomena, optical and corpuscular.

PHYSICS, THEORETICAL (continued)

1834 The Variational Method for the Continuous Wave Function of an Electron in the Field of a Neutral Atom by Su-Shu Huang Phys Rev 75 980-981 (1949) Mar 15 (Letter to the editor)

Hulthuén's formulation of the variational method for the treatment of the continuous spectrum in the quantum theory [Kungliga Fysiografiska Sällskapets i Lund, Förhandlingar 14 No. 21 (1944)] has been generalized by the author for the case of electron scattering by a neutral atom. From this derivation for the simplest case, i.e., that of the neutral hydrogen atom, the author concludes that the result obtained would also follow for the case of a free electron in the field of a neutral atom with more than one electron. The mathematically simpler form of Hulthuén's generalization, as formulated by Tamm [Zhur Eksptl i Teoret Fiz 18 No 4 (1948)] is considered next and it is shown that the two formulations of the variational principle are equivalent.

RADIATION CHEMISTRY

1835 Studies in the Hyaluronidase - Hyaluronic Acid System. I. The Effect of X-Irradiation on Hyaluronic Acid by Alice L Mathis, Robert E Brooks and Herman Schneiderman. AECU-170 (UCLA-11) Feb 11 1949 10p

Hyaluronic acid is a mucopolysaccharide which is believed to be composed of equimolecular amounts of acetyl glucosamine and glucuronic acid. X-irradiation was found to cause a change in potassium hyaluronate solution, which manifests itself by a reduction in viscosity. After cessation of the irradiation, the viscosity decreased to some extent for a period of about five hours.

1836 The Effect of Pile Bombardment of Uncured Elastomers by W L Davidson and I G Geib Rubber Chem and Technol 22 138-147 (1949) Jan

This article is based on MDDC-1449. An abstract of this document has been listed in Abstracts of Declassified Documents I 783 (1947) Dec 30.

RADIOACTIVITY

1837 Proof of Existence and Characteristics of Long-Lived Antimony in Fission by G R Leader and W H Sullivan (Plutonium Project Record Vol 9B Chap 7 ed by N Sugarman). AECD-2557 nd Decl Apr 6 1949 14p For publication in NNES

The existence of the controversial long-lived Sb activity was proved in a series of experiments. The half-life is 2.7 years. Associated with the activity are 0.5 Mev electrons, 0.56 Mev γ-rays, and strong $\sim$0.026 Mev x-rays.

1838 The Radiations from 24.1 Hour W^{187} by Paul W Levy. AECU-173 (ORNL-312) Mar 29 1949 20p

The radiations from 24.1 hour W^{187} have been investigated with counter and photographically recording beta-ray spectrometers. The continuous beta-ray spectrum consists of at least two components and there is an indication that a third is also present. The maximum energies and the intensities of these components are: 1.318 Mev, $\geq$12 per cent; 0.627 Mev. $\geq$65 per cent; $\approx$0.38 Mev, $\leq$23 per cent. Gamma-rays of 0.133, 0.204, 0.478, 0.615, 0.680 and 0.767 Mev are present. In addition, a photoelectron line is observed that can be attributed either to a gamma-ray of 0.127 and/or 0.061 Mev, or to the Re X-rays accompanying internal conversion electrons. 16 references.

1839 The β-Spectrum of H^3 by G C Hanna and B Pontecorvo Phys Rev 75 983-984 (1949) Mar 15 (Letter to the editor)

The proportional counter technique previously described [Phys Rev 74 497 (1948): 75 985 (1949)] has been used to study the B-spectrum of H^3, an investigation of which has recently been reported by Curran et al [Nature 162 302 (1948)]. Two counter types were used with fillings of xenon, argon, methane, hydrogen, H^3, and A^{37}. The H^3 spectrum in the region of the end-point is shown as well as a Kurie plot of the H^3 spectrum; the latter is compared with the theoretical curve. The results indicate that the initial assumption of a zero neutrino mass is correct within the limits of the experimental error. From the data obtained the extrapolated end-point has been determined as 18.9 ± 0.5 Kev which is somewhat higher than previous values.

RADIOACTIVITY (continued)

1840 The Gamma-Rays Following Au^{198} β-Decay by D Saxon and R Heller Phys Rev 75 909-910 (1949) Mar 1 (Letter to the editor)

This article is based on AECD-2290. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 1-1188

1841 On Radioactive Nuclei of the Type $_ZM^{2Z-1}$ (O radioaktivnykh yadrakh tipa $_ZM^{2Z-1}$) by V S Dzhelepov Doklady Akad Nauk SSSR 62 51-54 (1948) Sept 1 (In Russian)

A theoretical treatment of the extensive experimental material on the β-decay is hampered by the fact that it is difficult to establish a relationship between the decay constant and the decay energy. In Fermi's theory this relationship is given by a formula which includes a matrix element depending on the often unattainable wave functions of the nucleus before and after the disintegration. Wigner has pointed out [Phys Rev 51 104 (1937); 56 519 (1939)] that for nuclei of the type $_ZM^{2Z-1}$ the problem does not present any such difficulties. The present author analyzed data on the decay period and the spectrum limit of 13 nuclei of that type (from C^{11} to Sc^{41}). He found that almost all fundamental characteristics of the β-decay of these nuclei can be calculated a-priori. The following are some of the rules established. Beginning with C^{11} all nuclei of that type emit positrons. This β-decay is a permitted transition to the ground state of the daughter nucleus. It is not accompanied by a γ-radiation. To a given Z correspond only one value of the decay energy and only one value of the decay constant. The ratio of the K-capture probability to that of the positron emission depends only on Z.

1842 On the Beta-Particle Spectrum from the Decay of Tritium by W J Bratt, F T Rogers Jr and Arthur Waltner Phys Rev 75 909 (1949) Mar 1 (Letter to the editor)

A reduction of previously reported data on the β-particle spectrum from the decay of tritium [Phys Rev 74 699 (1948)] has been completed and the results obtained are discussed. By numerical solution of the rather complicated relevant integral equation, a differential distribution of true track lengths was obtained; this, after consideration of the small effects of straggling, was converted to a differential energy-distribution; finally, this last distribution was compared in the standard way with the theory of Fermi. The cloud-chamber data result in an extrapolated and-point energy of 17.0 Kev, which is in extremely good agreement with the 16.9 Kev recently obtained [Nature 162 302 (1948)] by Curran, Angus, and Cockcroft. It is noted that this agreement has a significant bearing upon the results reported recently [Waltner and Rogers, Jr., Phys Rev 74 699 (1948)] on the low energy portion of the β-particle spectrum from the decay of RaE.

1843 Some Characteristics of Antimony (125) by C E Mandeville and E Shapiro Phys Rev 75 897-898 (1949) Mar 1 (Letter to the editor)

Activities of Sb^{125} are discussed which were obtained when metallic tin was irradiated by slow neutrons in the Oak Ridge pile. A curve showing the aluminum absorption of β-rays of the 2.7—year antimony is shown. The β-γ-coincidence rate of Sb^{125} is also shown; this seems to be independent of the β-ray energy, suggesting a simple spectrum. Since the coincidence rate is constant out to the end-point of the 01 0.704-Mev β-ray group, it can be concluded that the high-energy β-rays do not go directly to the 60-day tellurium level but are followed by γ-rays which then lead to the tellurium isomer. The β-γ-coincidence rate, 0.42×10^{-3} coincidence per β-ray, suggests that the β-rays of the high energy group are followed by 0.31 Mev of "immediate" γ-ray energy. An aluminum absorption curve for the conversion electrons of $^*Te^{125}$ is also shown. The end point occurs at 18 mg/cm^2, 120 Kev, in exact agreement with the earlier measurement [Friedlander, Goldhaber, and Scharff-Goldhaver, Phys Rev 74 981 (1948)]. Extrapolation of the curves gives an end point at 12.7 mg/cm^2 or 93 Kev. This corresponds to a 2^5-pole isomeric transition. A coincidence absorption experiment disclosed the presence of the 1.7-Mev γ-ray of Sb^{124} in the antimony fraction.

RADIOTHERAPY

1844 Influence of Cosmic Radiation on Experimental Tuberculosis by S G Ong Nature 163 244-245 (1949) Feb 12 (Letter to the editor)

The influence of cosmic radiation on experimental tuberculosis in mice has been investigated at an altitude of about 3500 m. Mortality curves are shown for the four types of experimental conditions used in the first series of experiments in which the tubercle bacilli were injected at sea level, i.e., 1) direct exposure to cosmic radiation, 2) screened from cosmic radiation, 3) exposure to cosmic radiation under 2 cm of lead (giving maximum shower intensity), and 4) exposure to the hard component, only, of the cosmic radiation. The curves indicate that screening from cosmic radiation and exposure to daylight and ultraviolet light (the hard component of cosmic radiation) were beneficial. In a second series of experiments the bacilli were injected into the mice at the 3500 m altitude and were thus immediately in contact with a low oxygen intake tension in the lung which would be expected to inhibit progress of the disease. Weight curves are shown for the mice studied under the following conditions: 1) exposure to artificial light and screening from cosmic radiation, 2) exposure to artificial light and to the direct action of cosmic radiation, 3) exposure to artificial light under 2 cm of lead, and 4) exposure to artificial light under 10 cm of lead. As in the first series, the weight of the mice in the group exposed to the cosmic radiation was higher than for the other groups, although the mortality curves showed no significant differences for the four groups. The greater the exposure to the soft component and the showers of cosmic radiation, the more the loss of weight was retarded. Hemorrhages were observed in the mice exposed to cosmic radiation in both series of experiments.

1845 Measuring Dosage: Electronic Aids in Radiotherapy by H A Hughes Electronic Eng 21 No. 253 80-86 (1949) Mar

The practice of radiation dosimetry has derived much benefit from the application of electronic forms of instrumentation. Further improvements may arise from the reduction of background fluctuations of currents or "noise" in the first stage of amplifiers used with ionization chambers. The most important noise factor in amplifiers for use with fast ionization chambers converting the band 0.5-5 Mc/s. is anode current shot noise. An increase of signal/noise ratio may be obtained by reducing the input capacity, a problem for the valve designer. In amplifiers covering the band 200 Kc/s.-2 Kc/s. for use with slow air-filled ionization chambers, grid current shot noise predominates. A reduction in grid current will bring about reduced noise. It appears then that improvements in amplifier design are dependent upon further valve development.

In the case of steady ionization current measurement the most accurate instruments are those which employ a null method such as the Townsend balance or Kemp comparator. This is in accordance with general physical practice. As far as deflection methods are concerned, an improvement in the stability of very high input resistances will enable greater reliance to be placed on instruments involving their use.

1846 Potential Hazards from Radiation Treatment of Hypertrophied Lymphoid Tissue in the Nasopharynx by Laurence L Robbins and Milford D Schulz Laryngoscope 59 147-155 (1949) Feb

In view of the present vogue for treating hypertrophied lymphoid tissue in the nasopharynx with radium, a warning of possible resultant dangers is offered. With the idea in mind that mistakes of the past may not be repeated in the present, certain precautionary measures are suggested: 1. that the use of the monel applicator should not be routine; 2. that for benign lesions in children and young people this treatment should be carried out cautiously and only after careful consideration of each case; 3. that, except in the selected case, the treatment when given should consist of no more than erythema dose; 4. that what constitutes an erythema dose should be determined for a given applicator; and 5. that should no other means of determining the proper dosage for an applicator be available, the operator should estimate it be trial on his own skin.

RADIOTHERAPY (continued)

1847 Principles of Fast Electron Therapy in Cancer by Erich M Uhlmann and Lester S Skaggs Amer J Roentgenol and Radium Therapy 61 232-235 (1949) Feb

The method of production of an electron beam by the betatron is outlined briefly and the possible value of free electron therapy in the treatment of malignant disease is discussed. Free electrons thus produced are more easily controlled than are the secondary electrons produced during the passage of roentgen rays through tissues. Another advantage in the use of such fast electrons is the fact that the highest concentration of energy occurs at the end of the beam, rather than at its source. Thus, a free electron beam of sufficient energy can be directed and applied in such a manner that the concentration is greatest in the tumor itself. However, considerable further work will be necessary before clinical application of the betatron in the treatment of malignant tumors can be safely recommended. The effects of scattering are emphasized in the discussion of this article: these are of importance since scattering causes the maximum ionization produced by the beam to occur in the first half of the range. Scattering is less for higher energy electrons, but this might produce considerable ionization beyond the tumor and possibly at the exit skin.

1848 Radiation Treatment in Carcinoma of the Cervix by Milo Harris Northwest Med 48 178-179 (1949) Mar

A group of 183 cases of carcinoma treated during 1937 to 1943, were surveyed for 5 year survivals. Of these cases, 140 were treated by divided doses of radium and X-irradiation in an attempt to cure the malignancy. Of the entire group, 78 were alive at the end of 5 years following treatment, a total cure rate of 42%. From 140 cases considered suitable for full treatment, 73 were alive at the end of 5 years, a relative cure rate of 51%.

RARE EARTHS AND RARE EARTH COMPOUNDS

1849 Computation of the Ionization Potentials of Several Lanthanides with the Aid of Kapustinskiĭ's Equation (Vychislenie potentsialov ionizatsii nekotorykh lantanidov pri pomoshchi uravneniya Kapustinskogo) by K B Yatsimirskiĭ Izvestiya Akad Nauk SSSR Otdel Khim Nauk No. 5 554-555 (1948) Sep-Oct (In Russian)

The total ionization potential can be calculated from the equation $I = H_M - H_S$, where H_M is the heat of formation of the gaseous ion M, and H_S is the heat of sublimation. H_M is found from $H_M = (H_{MX} - mH_X + U)/n$, where H_{MX} is the heat of formation of the crystalline compound M_nX_m, and U is the latice energy which can be determined from an equation given by Kapustinskiĭ [Zhur Obschei Khimii 13 497 (1943)]. By this method the following values of I (in volt-electrons) were found: La^{+++}: 36.4; Ce^{+++}: 37.1; Pr^{+++}: 37.7; Nd^{+++}: 38.2; Sm^{+++}: 38.2; Er^{+++}: 40.0. The successive ionization of the first, second, and third electron requires: La: 5.6, 11.4, 19.4; Ce: 6.54, 14.8, 15.8; Sm: 6.55, 11.4, 20.2 volt-electrons.

1850 Contributions to the Analytical Chemistry of Rare Earths (Beiträge zur Analytischen Chemie der Seltenen Erden) by G Beck and A Gasser Analyt Chim Acta 3 41-51 (1949) Jan (In German)

It is shown that by a fractional separation of the rare earths by means of the nitriloacetic complexes in the presence of oxalate, the light earths of the group (Nd to Dy) are transformed into insoluble oxalates, while the heavy ones remain in solution, in the form of nitriloacetic complexes, according to the following scheme: $Me_3[Nd, Sm, Gd(N(CH_2COO)_3)_2] + (Sm, Gd, Dy)_2(C_2O_4)_3 \longrightarrow Me_3[Sm, Gd, Dy(N(CH_2COO)_3)_2] + Nd_2(C_2O_4)_3$. Samarium is separated rapidly and quantitatively by formation of an amalgam, according to Marsh's method, which facilitates its separation from the other elements. The stability of the nitriloacetic complexes as a function of pH has been studied. The ammoniacates of the chlorides of Sm, Gd, Dy, Er and Y have been prepared and submitted to thermal decomposition.

SPECTROSCOPY

1851 Investigations into X-Ray Absorption Spectra of Rare Gases with Geiger Counters and Bent Crystal by Gösta Brogren Nova Acta Regiae Societatis Scientiarum Upsaliensis 14 No. 4 (1949) 64p

Using a bent crystal spectrometer of the type previously used by Johann [Z Physik 69 185 (1931)] in conjunction with Geiger counters, the X-ray absorption spectra of the rare gases Ne, A, Kr, and Xe have been investigated. Detailed descriptions of the method and the experimental arrangements are followed by a discussion of some of the factors which must be considered in connection with the Geiger counters used. A new improved type of counter was used to increase the efficiency of the instrument in registering X-ray intensities. The absorption edges of the rare gases were examined in the 800-14500 XU range and the results obtained seemed to indicate that the secondary structure following the edges was due to resonance absorption lines corresponding to transitions from X-ray levels to external optical ones. Data for the term values, X-ray level width and emission wave lengths are given. 21 tables and extensive bibliography.

TRACER APPLICATIONS - BIOLOGY

1852 The Utilization of Radioactive Glycine in the Livers of Normal and Depleted Mice by George L Nardi. AECU-177 (UCRL-305) Mar 14 1949 10p

Mice maintained for 72 hours on normal diet, glucose diet and water diet were injected with C^{14} methylene-labeled glycine and sacrificed two, four and six hours after injection. Liver biopsies showed some vacuolization in the glucose animals and marked changes in the water animals. Total liver activity was determined and an aliquot hydrolyzed. The amino acid fraction of the hydrolysate was removed by passing the latter through an ion exchange column and the activity of the glucose fraction determined. The amino acid solution was concentrated, and two-dimensional paper chromatograms made and radioautographs of the latter were then produced in an attempt to determine the radioactive products. Glucose-fed animals showed the highest percentage of both active amino acids and active glucose, with the highest rate of radiocarbon turnover. Radioglycine was present in all livers. Radioserine seemed to be formed sooner in the normal and glucose animals. The water animals showed presence of radiocystine not present in the other two groups.

1853 The Synthesis of Nucleic Acids during the Lag Phase of Cultures of Escherichia Coli B I. Normal Cultures by M L Morse and C E Carter. AECU-180 (ORNL-317) Apr 1 1949 16p

The present study was undertaken to establish the normal patterns of synthesis of ribonucleic and desoxyribonucleic acid in Escherichia coli by means of microchemical procedures and with the use of P^{32}. Cultures in the lag and early logarithmic phase of growth were examined. Five to tenfold increases in the ribonucleic acid (RNA) content of the cells were observed, while desoxyribonucleic acid and nitrogen contents increased but threefold. The rapid synthesis of RNA was confirmed by the use of radiophosphorus.

1854 Absorption of Radioactive Calcium by the Peanut Fruit by Roger W Bledsoe, C L Comar, and H C Harris Science 109 329-330 (1949) Apr 1

Through the use of Ca^{45} in experiments on peanut plants it is shown that a supply of calcium to the roots is not adequate for complete fruit development. After a definite point, further fruit development is apparently dependent upon the external supply of calcium in the soil surrounding the fruit.

1855 Downward Translocation of Phosphorus in Separated Maize Roots by Robert F Moore Amer J Botany 36 166-169 (1949) Feb

Eighty-one maize plants were grown with their roots divided between 2 independent culture solutions arbitrarily called "A" and "B". The "A" solution contained KH_2PO_4 which was labelled with radioactive phosphorus (P^{32}). The "B" solution never initially contained the radioactive phosphate. Labelled phosphate ions were detected, by means of a Geiger-Müller counter, in all parts of the shoot

TRACER APPLICATIONS - BIOLOGY (continued)

after approximately 2 hr. Labelled phosphate ions were detected in the roots growing in the "B" solution after approximately 6 hr. Labelled phosphate ions were detected in the "B" solution after approximately 96 hr. It is concluded that (a) there is a substantial downward movement of phosphorus in maize roots; (b) this movement occurs only after phosphorus has first been translocated to the shoot; (c) downward movement of phosphorus to the roots is greater when the roots are growing in a phosphate-deficient medium; (d) The primary roots of maize plants have a greater phosphorus absorbing capacity, under the conditions of this experiment, than do the adventitious roots; and (e) there is a slight efflux of the phosphate anion from maize roots.

1856 The Incorporation of P^{32} into the Nucleoproteins and Phosphoproteins of the Developing Sea Urchin Embryo by C A Villee, M Lowens, M Gordon, E Leonard and A Rich J Cellular and Comp Physiol 33 93-112 (1949) Feb

Sea urchin embryos incubated 3 to 72 hours and analyzed by the method of Schmidt and Thannhauser [J Biol Chem 161 83-89 (1945)] showed an increase in desoxyribonucleic acid (DNA) with time, whereas the ribonucleic acid (RNA) remained essentially constant. Experiments with P^{32} showed that the DNA synthesized did not come from the RNA of the unfertilized egg and render unlikely the hypothesis that it is formed from an RNA precursor.

The effects of dinitrophenol, malononitrile, uranyl nitrate, tris (β-chloroethyl) amine, and low temperature on phosphate and nucleic acid metabolism were measured with the aid of P^{32}. Dinitrophenol and uranyl nitrate reduced the uptake of phosphate by the cells and had little additional effect on nucleic acid metabolism. Malononitrile and tris (β-chloroethyl) amine had lesser inhibitory effects on phosphate uptake but greater effects on nucleic acid metabolism; malononitrile had a greater inhibitory effect on RNA synthesis and tris (β-chloroethyl) amine a greater inhibitory effect on DNA synthesis. Low temperature markedly reduced the uptake of P^{32} by the cell. Some implications of these findings with regard to phosphorus and nucleic acid metabolism in development are discussed. 29 references 5 tables.

1857 The Permeability of Capillaries to Sodium as Measured in the Rabbit by the Use of Radiosodium (La perméabilité capillaire au sodium mesurée chez le Lapin à l'aide du radio-sodium) by F Morel and M Marois Compt Rend Soc Biol 142 1366-1369 (1948) Nov (In French)

Na^{24} in the form of NaCl (0.007) was injected in amounts of 1 cc per kg. body weight into the jugular vein of rabbits. Samples were removed by means of a canula in the carotid artery every 5 seconds during the first 2 minutes and then at 10, 20, and 60 second intervals. The radioactivity was measured and the readings placed on a graph. Three phases were observed: (1) a rapid rise in activity corresponding to distribution of activity in the general circulation, (2) a decrease caused by the passage of the Na^{24} through the capillary walls, and (3) a level stretch when equilibrium is reached. In the second phase the decrease follows a simple exponential law. If it is accepted that the liquid passing through the membrane wall is the same concentration as the plasma it is possible to figure the volume of capillary exchange (D): $D = \frac{P}{3.4}$ cm^3/sec/kg (if p is expressed in mg/sec and per kg). In this experiment the average of D equalled 0.65 cm^3/sec and/kg in each direction through the capillary wall.

1858 Studies in Protein Metabolism of the Amphibian Embryo I. Uptake of Radioactive Glycine by Felix Friedberg and Richard M Eakin J Exptl Zool 110 33-46 (1949) Feb

The incorporation of C^{14} of radioactive glycine into protein was studied in the embryos and larvae of the Pacific tree-frog, Hyla regilla. 5 tables of data.

1859 Studies with Colloids Containing Radioisotopes of Yttrium, Zirconium, Columbium, and Lanthanum I. The Chemical Principles and Methods Involved in Preparation of Colloids of Yttrium, Zirconium, Columbium, and Lanthanum by John W Gofman J Lab and Clin Med 34 297-304 (1949) Mar

This article is based on AECD-2057 (UCRL-91). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. I-60.

TRACER APPLICATIONS - BIOLOGY (continued)

1860 A Study of Histochemical Iron Using Tracer Methods by K M Endicott, T Gillman, G Brecher, A T Ness, F A Clarke and E R Adamik J Lab and Clin Med 34 414-421 (1949) Mar

Combined histochemical, radioautographic, and tracer methods were used to study the absorption and distribution of single test meals of radioiron in guinea pigs, rats, and one dog. The iron demonstrated histochemically in the duodenal mucosa, the mesenteric and cervical lymph nodes, liver, and spleen was derived largely from sources other than the single test meal. This visible iron did not undergo well-defined cyclic changes after a single iron meal. It accumulated over a period of days or weeks of continued intake of a diet containing considerable iron. It behaved more like storage iron than iron is transport. The visible granalur iron in the duodenal epithelium exerted no demonstrable effect on the amount of iron absorbed, and it did not appear to be a morphologic expression of mucosal block. Most of the radioiron of the test meal traversed the duodenal epithelium rapidly. In the dog it was transported from the intestine via the portal vein — only insignificant amounts being found in thoracic duct lymph. There was no evidence to indicate that the reticuloendothelial system participated directly in the absoption of iron from the intestine or transport of the absorbed iron from the intestine to the liver, blood, and other organs and tissues.

1861 Tissue Suspensions for Estimations of Radioactivity by Frank Howarth Nature 163 249 (1949) Feb 12 (Letter to the editor)

Working chiefly with brominated organic compounds, an appropriate method for the estimation of radioactive substances contained in tissues has been developed. Satisfactory suspensions were obtained by boiling the tissue under reflux in a solution of lithium hydroxide containing 20% of alcohol and afterwards washing out the condensers with a little alcohol. A suspension was obtained which remained reasonable stable for several hours.

1862 Tracer Experiments with C^{14} Urethan by Howard E Skipper (In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research," Dec 18-20, 1947, Auburn, The Alabama Polytechnic Institute, 129-134 (1948))

The specific steps which have been taken or are in progress to determine how and why urethane prolongs the life of leukemic animals so that the synthesis of a more effective molecule may be attempted are reported. They are (1) investigation of the localization of C^{14} from radioactive urethane in pertinent tissues of normal animals, (2) a study of the rates and routes of excretion of C^{14} from injected C^{14} urethane, (3) determination of the distribution of C^{14} from urethane in animals with various types of neoplastic disease, i.e., myeloid and lymphoid leukemia, mammary carcinoma, and sarcoma 180, and (4) isolation and identification of urethan degradation products. The details of the procedures are to be published in other papers.

C^{14} from carbonyl tagged urethane appeared in the expired CO_2 of injected animals within 10 minutes. By the end of 24 hours, roughly 90% of the injected radioactivity could be accounted for in the expired CO_2 which was collected quantitatively. This rate of appearance rules out uncatalyzed hydrolysis as the principal mode of degradation. The urine contained from 5 to 10% of the total C^{14}. The distribution of radioactivity in the tissues and body retention at 24 and 48 hours are given in tables.

1863 The Use of Ion Exchange for the Determination of Radioelements in Large Volumes of Urine by Jack Schubert, Edwin R Russell and Lawrence B Farabee Science 109 316-317 (1949) Mar 25

The ion exchange method has been used to make a quantitative extraction of a tracer element from a liter or more of urine and to concentrate it in a few ml of solution completely free from the large concentration of salts which usually interferes with spectrographic and chemical methods of analysis. In connection with metabolic studies it was necessary to determine quantitatively the concentrations of fission products in the urine, especially with regard to relationg the urinary levels of radioelements to body content, and a determination of the rare earths fraction was made using a cation exchanger.

TRACER APPLICATIONS - BIOLOGY (continued)

Carrier-free radioyttrium, Y^{91}, was chosen as a tracer element for these studies. A flow sheet of all the details of the necessary operations is given and the effects of various concentrations of albumin, urea, acids and NaCl on the adsorption process are discussed. Using the process described it is suggested that about 10^{-4} M of yttrium can be extracted with no loss of efficiency. The method gave consistent recoveries of Y^{91} of 90 ± 5% and an over-all recovery of 85 ± 5% and it is believed that these values could be raised by a closer control of variables.

TRANSURANIC ELEMENTS

1864 Absolute Fission Yield Experiments - Introduction by M S Freedman and E P Steinberg (Plutonium Project Record Vol 9B Chap 7 ed by N Sugarman) AECD-2558 nd Decl Apr 5 1949 12p For publication in NNES

The introduction is concerned chiefly with a description of a fission chamber used in the measurement of absolute slow and fast fission yields of Pu^{239}. The instrument is designed to operate inside an 8 inch square hole entering into the thermal column of the Argonne heavy water pile. In essence, the apparatus consists of a very small parallel-plate type ionization chamber, argon filled, surrounded by a thick boron cylinder, which is in turn enclosed in a uranium cylinder. The assembly is suspended in the cavity in the thermal column. The boron and uranium cylinders are not attached for the counting of slow fissions. Detailed drawings are given.

URANIUM AND URANIUM COMPOUNDS

1865 On the Partition of Uranyl Nitrate between Diethyl Ether and Aqueous Nitric Acid by Aina Norström and Lars Gunnar Sillén Svensk Kem Tid 60 227-234 (1948) Nov

Péligot observed in 1842 that uranyl nitrate is appreciably soluble in diethyl ether and used this property for separating uranium from other constituents of pitchblende. This method has since been used repeatedly for analytical and preparative purposes. The present investigation deals with distribution ratios. Aqueous solutions containing a small amount of uranyl nitrate and varying amounts of nitric acid and ammonium nitrate were brought to equilibrium with diethyl ether at 20°C. The distribution ratio of U and acid between ether and the aqueous layer were shown as functions of the acidity of the aqueous phase. Two cases were studied: (1) no NH_4NO_3 added, and (2) saturation with NH_4NO_3. The advantage of adding NH_4NO_3 was observed, and conclusions were drawn for practical work.

1866 Fission Fragment Energies in U^{235} and U^{233} by D C Brunton and G C Hanna Phys Rev 75 990-991 (1949) Mar 15 (Letter to the editor)

Experiments were undertaken to determine the energy distribution of the fission fragments of U^{233}. A double "back-to-back" ionization chamber was used with a thin source mounted on the common cathode. Electron collection was employed with Frisch grids shielding the collecting electrodes [Cranshaw and Harvey, Can J Research July (1948)]. The fission source was a collodion film of ~14 $\mu g/cm^2$ containing 3-5 $\mu g/cm^2$ of U dissolved in it and the neutron source was the thermal column of the Chalk River pile. The results obtained have been tabulated and compared in tabular form with previous data of a similar nature for Pu^{239} and U^{235}. Contour diagrams of the fission modes in U^{233} and a curve of the variation in the total kinetic energy with the mass ratio for U^{235} and U^{233} are also given.

VACUUM SYSTEMS

1867 High Vacuum Technique by R Witty Electronics Forum 10 5-26 (1948) June

The technique of working with a high vacuum is reviewed under the following three main topics: (1) production of low pressures, (2) measurement of low pressures, and (3) the design of high vacuum equipment. 24 references.